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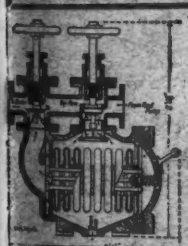

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THE HEATING AND VENTILATING MAGAZINE

1123 BROADWAY NEW YORK APRIL, 1912

The New Thoughts Concerning Ventilation

SYMPOSIUM OF THE VIEWS OF MEDICAL AND OTHER EXPERTS

The presence of a notable group of medical and other authorities at the recent annual meeting of the heating engineers' society and their participation in what became a debate on modern ventilation methods resulted in an expression of views that may well be considered a summary of the recent criticism of present heating and ventilating practice. The main points brought out by the speakers are presented herewith:

DR. W. GILMAN THOMPSON (Professor of Medicine in the Cornell University Medical College in New York City): I think it very desirable that medical men and those interested in these practical ventilation problems should get together. When one is called on to give testimony, one should present one's credentials; and, as far as the problem of ventilation is concerned, mine are that I have worked personally in three of our largest metropolitan hospitals where elaborate systems of ventilation have been installed and are no longer in use, it having been the experience of physicians that they are pernicious for various reasons.

Ventilating problems may be stated from two points of view: one is the physical and one the physiological. I have undertaken the physiological research with instruments of precision, by studying the effect on the individual; and that problem, I admit, has been very much neglected by physicians in regard to accurate determinations.

A number of us lately have been trying to find out why it is that one feels better in fresh air than one does in stale air and we have found some very interesting facts in regard to blood pressure. Without going into detail, I will say that we have instruments for measuring the blood pressure of the human circulation. The normal blood pressure at the wrist in the radial artery in the adult is 140 mm. of mercury. If the pressure falls much below that figure, it means a poor blood supply all through the body, and if it rises much above that, you have other symptoms, such as variations of functional activity. And between fresh and stale air we found most interesting and surprising facts about blood pressure, particularly in children.

In children, the normal blood pressure is about 100 mm. of mercury. A child having pneumonia and kept 22 hours in a closed ward having all the modern ventilation appliances and the best air that could be given, had a subnormal blood pressure. Being placed outdoors the blood pressure promptly

rose to normal and remained so while the child was in the outdoor air. On being brought indoors again, the blood pressure dropped to a very dangerous degree within 30 or 45 minutes, to a subnormal pressure of 80 mm. of mercury, instead of 100 mm.

Coincident with such blood pressure changes, in the cases of delirious patients, the delirium clears up in fresh air more quickly than in stale air and the fresh air also has marked effects on the activity of the secretions and special functions.

Much has been said in regard to the effect of humidity, and just at present this is a fashionable thing in connection with ventilation. According to some writers whose articles I have read, you may have the atmosphere surcharged with marsh gas, hydrogen sulphide and carbon dioxide and, provided the humidity is normal, you are quite "comfortable." These are all gases of the human body and capable of being discharged into the air. I still believe that carbon dioxide tests afford something of a measure of the other exhaled impurities in the atmosphere of a room for it fluctuates with them. While I admit that humidity has much to do with one's "comfort," it has less permanent influence on the respiratory function than many other factors.

I came into this room an hour after this session commenced and the air was very "uncomfortable," yet those who had been sitting here were quite "comfortable." We physicians also discuss ventilation problems in the most atrociously ventilated rooms. It was uncomfortable when I entered the room but after I had stayed here awhile and listened to the discussion on humidity, I became much more "comfortable."

In estimating the effect of humidity, its action is chiefly upon the cutaneous nerves and circulation rather than upon respiration, at least as far as "comfort" is concerned, and one's nose is an infinitely better test of the fitness of the air for breathing than a humidity test.

The statement has been made that it is difficult to raise the temperature of the air to 400° F. in a heating system. The records show that this was really the standard at the Presbyterian Hospital, in New York, at one time. This effects some subtle change in the quality of the air. You can live on such air, but there is no "uplift" about it. The growing child needs to have the very best conditions for its development and vitality, for the activity of its circulation and respiration. If the designing engineers for public school heating apparatus and the boards of education would only sit in the schoolrooms for a few hours themselves and not rely so much on hydrometers and thermostats, etc., we should come to some practical results.

PROF. C. E. A. WINSLOW (Associate Professor of Biology, College of the City of New York): The subject of ventilation has been extensively discussed in the public press during the last few months. I do not believe that the daily paper is the place to settle a complex technical subject of this kind, and I doubt if the results reached in such a way are likely to be of scientific value or are likely to prove really helpful in public education.

None of us is prepared to deny that many ventilating systems have proved failures. We know that something is wrong, but we differ as to the diagnosis and the remedies. It has been assumed by many that the trouble was with the whole practice of ventilation and that it should be discarded in favor of open windows.

"Back to Nature" is the cry. This, I believe, is a wholly mistaken view and as unreasonable as it would be to conclude that because the New York water supply is sometimes dirty we should wreck our aqueducts and tell every citizen to dig a well in his own back

yard. Back to Nature is seldom the solution of any problem. All along the line civilized man is improving upon Nature and there can be no question that when we determine just what quality of air we need, it will be feasible to supply that air to the occupants of rooms by the use of mechanical devices.

On the other hand, it is quite impossible to control the condition of the air in an enclosed space in cold weather by opening windows, for if those at a distance from the windows feel comfortable, those near the windows must inevitably be exposed to unendurable drafts.

The trouble has not been with ventilation *per se*. Neither, in my judgment, has it rested mainly with the designing engineer, but with the sanitarian who has failed to tell the engineer what to do, and with the janitor who has failed to operate the plant properly after it is installed.

Up to two years ago the designing engineer was told that all he had to do, for instance, in order to ventilate a school, was to supply 30 cu. ft. of air per pupil per minute. Nothing in particular was said to him about the quality of the air. Even today, the sanitarian is unable to give a full or satisfactory answer to the question as to what sort of air the engineer should furnish.

We know that a temperature of over 70° F. is distinctly harmful. We know that too much humidity is bad and we are reasonably sure that too little humidity is also bad; just how much or how little, we cannot say as yet. These are all points which can be solved, however, and their solution is one of the most interesting problems of the next ten years. The fundamental aspects of water supply, sewage disposal and garbage disposal have been practically worked out. The live question in sanitation at present is this question of air supply.

We must determine exactly what degree of temperature and what frequency of air change is most favorable for the human machine. When that is known, there will be no difficulty at all in designing systems to provide the proper kind of air. We shall then need to emphasize the fact that it is a poor plan to build an elaborate mechanical ventilating system and allow it to be inefficiently operated. We must also turn our attention to the administrative problems in the running of the plant after it is installed.

The first thing we need, however, is more light as to the physiological effects of air conditioning upon the human body. Who is going to furnish the answers to these questions? I believe it will be primarily the ventilating engineers, and the public health experts, for whom the question of air supply has a direct and immediate interest, rather than the medical men whose interests lie in wholly different lines, or the physiologist whose attention is directed rather to the theoretical side of physiology than to immediate sanitary applications.

The engineer and the sanitarian will need to call in the medical man and the physiologist, just as the water supply engineer has solved his problems with the coöperation of the chemists and bacteriologists.

The question of air supply is a public health question and is going to be attacked by those who are primarily interested in public health; particularly by the engineer, who, in order to design his system adequately, must have more information than he now possesses. He will call in experts of all sorts to assist him, but he is likely to be himself the pioneer in this field.

It is to the Committee on School Ventilation of the American Society of Heating and Ventilating Engineers and to the committee on the same subject of the American School Hygiene Association and to the committee shortly to be formed by the Sanitary Engineering section of the American Public Health Association that I look for important constructive work in the next few years.

MR. W. THURSTON OWENS (Associate Editor, *American Gas Light Journal*): The gas industry is in the business of producing ventilation quite as much as those connected with this society, its apparatus consisting of the gas in combustion for light, heat and power. The heat produced increases natural ventilation in a marked degree, and many men in the industry who have seen it so successfully perform this function often wonder at the efforts that are being made to enforce compulsory ventilation laws.

It is the opinion of many that should a building be so constructed that there should be a large increase of carbonic acid gas at the breathing level, in rooms where gas is used for lighting, provision should be made for forced ventilation without reference to the quantity of gas consumed but rather to be determined by the number of people and their occupation.

An exhaustive investigation of this subject was made in London by Dr. S. Rideal and reported in a paper before the Royal Sanitary Institute in 1908, as follows:

(An extended review of this report was published in THE HEATING AND VENTILATING MAGAZINE for November, 1911.)

"(1.) Owing to the better ventilation obtained by gas, the products of combustion are not found in the air in anything like the proportion which might be expected, the temperature and humidity in an occupied room being no greater than when the room is lighted with electric light.

"(2.) Carbonic acid gas has not the injurious effect which was formerly attributed to it, but considerable rises in the temperature and moisture content of a room, from whatever source, do have a prejudicial effect upon the well-being of the occupants. Even under adverse conditions of ventilation purposely created for this inquiry, neither the temperature nor percentages of moisture in the room reached a point at which any such effect could be detected by any of the recognized physiological tests.

"(3.) It has been established that the products, viz., heat, carbonic acid and moisture, so far as they modify the health of the occupants of a room, are derived from the inmates more than from the illuminant, and that a room of moderate size can be efficiently lighted with gas without sensibly affecting the amount of these factors.

"(4.) Whilst undoubtedly it is as important to ensure adequate ventilation in domestic rooms, this, with present methods of construction, is better ensured the smaller the room. The problem of securing efficient ventilation in public rooms of a larger size has been outside the scope of this inquiry.

"(5.) The medical conclusions are in accord with those arrived at from the chemical and physical data, and also demonstrate that the choice between the two systems of lighting does not depend upon hygienic considerations."

While it seems quite generally agreed that CO_2 from combustion is not harmful in small quantities, it is important to note that in a report covering a period of five years, Dr. J. S. Haldane and his associates recommend that the standard for ventilation in rooms where gas is used for illumination be as follows: the proportion of CO_2 at the breathing level not to exceed 20 parts in 10,000 volumes.

The writer trusts that these investigations will receive further attention from those working toward bettering the conditions in factories, and I am sure that the gas industry stands ready to welcome suggestions and to coöperate towards bettering hygienic conditions and bringing about the smokeless, dustless city.

FRANK G. MCCANN, (Chief Engineer, New York City's Department of Education): To me the school house is like the factory

where the incoming children are the raw material and the output consists of more or less well-equipped citizens. Anything, therefore, that will prevent turning out of imperfect output should be considered very seriously and, if possible, adopted.

The school house output is of the most vital interest to the owners of the factory—the public—as the future welfare of that public itself hinges upon the value and completeness of the training and physical equipment of its children.

The successful manufacturer of today does not hesitate to replace the machinery of his plant as often as may be necessary to keep his factory abreast of the state of the art, even though that machinery be in good condition and almost new, as he realizes that with antiquated machinery and obsolete methods he cannot hope to successfully compete in the world's markets.

How much more should the owners of the school factory discard apparatus which the state of the art shows to be inadequate or obsolete?

It is a self-evident fact that while the children and teachers in our schools are working under unsanitary and debilitating surroundings they cannot show the rate of progress that could be made under more perfect and hence more favorable conditions. The loss of time caused by lowered vitality costs the taxpayers very large sums, as children thereby are compelled to repeat the work of the different grades, requiring added teachers, more school rooms, books, etc., to care for them.

The loss to the public is also increased by the expense involved in feeding and clothing those "repeaters" for the years thus wasted when they should be "earners" instead of "dependents." Further, the public loses by the lowered efficiency of its future citizens involved in the loss through training and impaired or lessened vitality caused by such unsanitary conditions of the school rooms.

It is obvious that for economic reasons, to say nothing of higher reasons, the best that can be designed should be provided for our schools, for old schools as well as new.

The fact that little has been done in this matter of bettering old schools entirely justifies the criticisms that from time to time have been made as to bad conditions in public schools of this and other cities.

On the other hand, many of the statements made in those criticisms have been incorrect, as the poorer examples have been selected as proving the impracticability of using any form of ventilation in schools other than by opening windows.

Open window ventilation has been shown to be unsafe, insanitary and unreliable, whereas properly designed and operated mechanical ventilation is safe, sanitary and reliable, and has been proven such in many cases.

I can take you to several schools, private or public, as you prefer, where modern ventilation is working successfully and giving satisfaction. I do not, however, claim that no improvements are desirable in these schools. I am a firm believer in air washing and humidity control, which none of these schools have, and several years ago I stated that were the funds available, I would install air washers, etc., in every school under by jurisdiction.

I further firmly believe that we should ozonize the air in connection with ventilation, and it seems to me that ozonization would enable the use of about one-half the air needed for adequate ventilation with air not so treated. Unfortunately, so far, I have heard of no means for controlling the amount of ozone to suit the momentarily varying needs, and also the amount of such needs has not as yet been definitely determined. There is also the danger with ozonizers that the electric discharges used to generate ozone may, because of overheated terminals,

generate nitric acid or nitrous oxide, either of which is injurious to the persons breathing it, and too much ozone is also injurious.

These matters are so vitally important to public welfare that I trust that in the near future tests will be made of such scope and variety that the questions raised here today may be settled and the art and science of ventilation may become fixed.

Much thought has been given to the character of such tests, and the problems presented thereby are not easy of solution.

The deleterious effects of impure air and poor ventilation are slow in appearing, but are none the less disastrous.

Local conditions of epidemic, such as colds, etc., show more rapidly than do the effects of bad air, and even the excitement created in the children and teachers in connection with experiments made upon them may nullify the data taken in such tests.

This matter is serious enough to merit, in my judgment, a very thorough series of tests being made by a corps of trained nurses and physicians working in harmony with experienced heating engineers, and the value of the results to be so obtained would warrant the expenditure of whatever sum may be necessary, either by the city, the state or the nation.

DR. C. WARD CRAMPTON (Director of Physical Training, New York City Department of Education): The problem of the ventilation of the schoolrooms of New York City has been studied for many years by the Bureau of Buildinigs, of which Mr. C. B. J. Snyder is the head, and by the Department of Physical Training. Two years ago, before the present popular agitation began, it became evident to me that many of the classrooms were overheated and that the then existing temperature standard of 68° to 72° F. was too high. Not only was it too high, but temperatures of 76° and 78° were common. Accordingly, the standard classroom temperature was lowered to 65° to 68° F., and the gymnasium temperature to 60° to 65° F. This naturally diminished the overheating, but it has not eliminated it.

The agitation against our present mode of forced ventilation is mainly, if not wholly, the result of observations of these overheated classrooms, and of some classrooms where defective apparatus is delivering but little fresh air. No one who has taught in or observed a classroom at its proper temperature, 65° to 68° F., with the plenum systems working properly, has ever complained to me that the ventilation was poor, for it was not poor.

The overheating is due, as a rule, to defective diaphragms in the direct radiation control and to other failures of the thermostat control. The occasional failure of the fan and duct mechanism is due to faulty control or lack of much-needed repairs.

The worst-ventilated rooms in the city, where I have found the air actually foul, are in the old buildings where we do not have plenum systems and the windows are relied upon exclusively for fresh air. It is evident that window ventilation can never furnish sufficient air for from 40 to 60 children in a room without some of the children being subjected to dangerous drafts of cold air. The result has always been that drafts are avoided and the air becomes bad.

FAULTS WITH PRESENT HEATING SYSTEMS

The faults I find with the present systems are as follows:

(1.) They are not automatic. It requires constant expert care, testing and renewal of important parts which quickly deteriorate. This is a matter which should be taken up most seriously by members of the heating and ventilating profession. We cannot afford, it is clear, to pay

more money for expert janitorial services, and while, in the main, the janitor engineer is expert and vigilant, yet there cannot fail to be exceptions. I maintain that there should be devised systems of automatic control that are really automatic and should not depend, to the present large degree, at least, upon human variability.

(2.) The present heating and ventilating systems often decrease the relative humidity of the air down to a point from 10% to 30%, which I consider deleterious. This can be corrected by evaporating pans, steam jets or mechanical fragmentation of water. At the present time, experiments of the various methods of humidifying the air are being conducted by Mr. C. B. J. Snyder.

There has been some talk about the physician being unable to set standards for ventilation. If you can guarantee a temperature of from 65° to 68° F. and an even relative humidity of from 45% to 55%, and a sufficient volume of fresh air (in accordance with present standards) mildly stirring about the room, I shall be satisfied.

I look to the future to improve ordinary outside air and make it mildly stimulating by the change of some of its O_2 into O_3. At present the difficulty with ozonizing apparatus is to secure constant results, and I am frankly in doubt exactly what percentage of ozone is desirable, on account of the present difficulties of control of supply. With this condition remedied, we shall be able to set standards for this new and comparatively unstudied factor in ventilation.

Dr. James H. McCurdy (Director International Y. M. C. A. Training School, Springfield, Mass.): Those who are studying the problem of ventilation in Springfield are doing so from the standpoint of a group of men, some 190 of them, who are taking vigorous exercise under direction. In using these men who are taking exercise for about two hours daily and studying what you might call the exaggerated conditions, we may get at some facts that it would be impossible to obtain from hospital or schoolroom conditions.

We have had a plant equipped so that we can control the relative humidity anywhere from 20% up to at least 80%; we can control the temperature automatically, so that we can run that up or down, as desired. We are studying the effect of variations of these conditions, making blood pressure tests, heart rate tests, etc. We have just got our plant equipped, so that we cannot give you definite reports with reference to these particular problems.

In the matter of blood pressure tests on the individual, we have found that this runs from 110 mm. up to 124 or 130 mm. of mercury, instead of 140 as has been stated by Dr. Thompson. With the boys in the high school, the figures ran from 110 to 120 mm. This is an average for 100 boys, each boy's condition being observed four to six times each day.

It seems to me this is one of the ways of checking the problems as to the effect of living indoors under conditions of active exercise. If we obtain certain results there, we may fairly assume that these will help, at least, in determining the conditions for health for the children who are studying quietly in the schoolroom.

I do not know whether we ought to have a high or low relative humidity. I do know that it is uncomfortable for a young man to work with the relative humidity below 25%; that is, he feels uncomfortable. I also know that when we run the relative humidity above 70%, he feels sticky and does not like it. There is a point somewhere where he gets greater comfort. Again when the temperature rises above 70° F., individuals are uncomfortable. We are trying to get the room temperature in the Training School

at Springfield down to 63° F. We are varying the humidity, but the variations above stated are the limits, clinically, beyond which it seems clear we cannot go, that is, from 25% to 70% for relative humidity and from 50° F. to 70° F. for indoor temperature.

Ventilation for a Sunday-School Auditorium

UNIQUE METHODS ADOPTED AT THE CHRISTIAN UNION CONGREGATIONAL CHURCH, UPPER MONTCLAIR, N. J.

Aside from the fact that the accompanying plans present a number of unusual features in the design of ventilating equipment, the successful operation of the system as installed, giving such marked satisfaction as to call for general comment, lends a timely interest to the scheme adopted. The system as illustrated herewith is used to ventilate the Sunday School auditorium and the rooms connected therewith at the Christian Union Congregational Church in Upper Montclair, N. J. It is intended to provide a sufficient volume of air, and to maintain its purity, for 600 persons, of which number about 350 are provided for in the auditorium proper. The cost of operating the heating and ventilating plant in a building of this character was one of the features that required careful consideration.

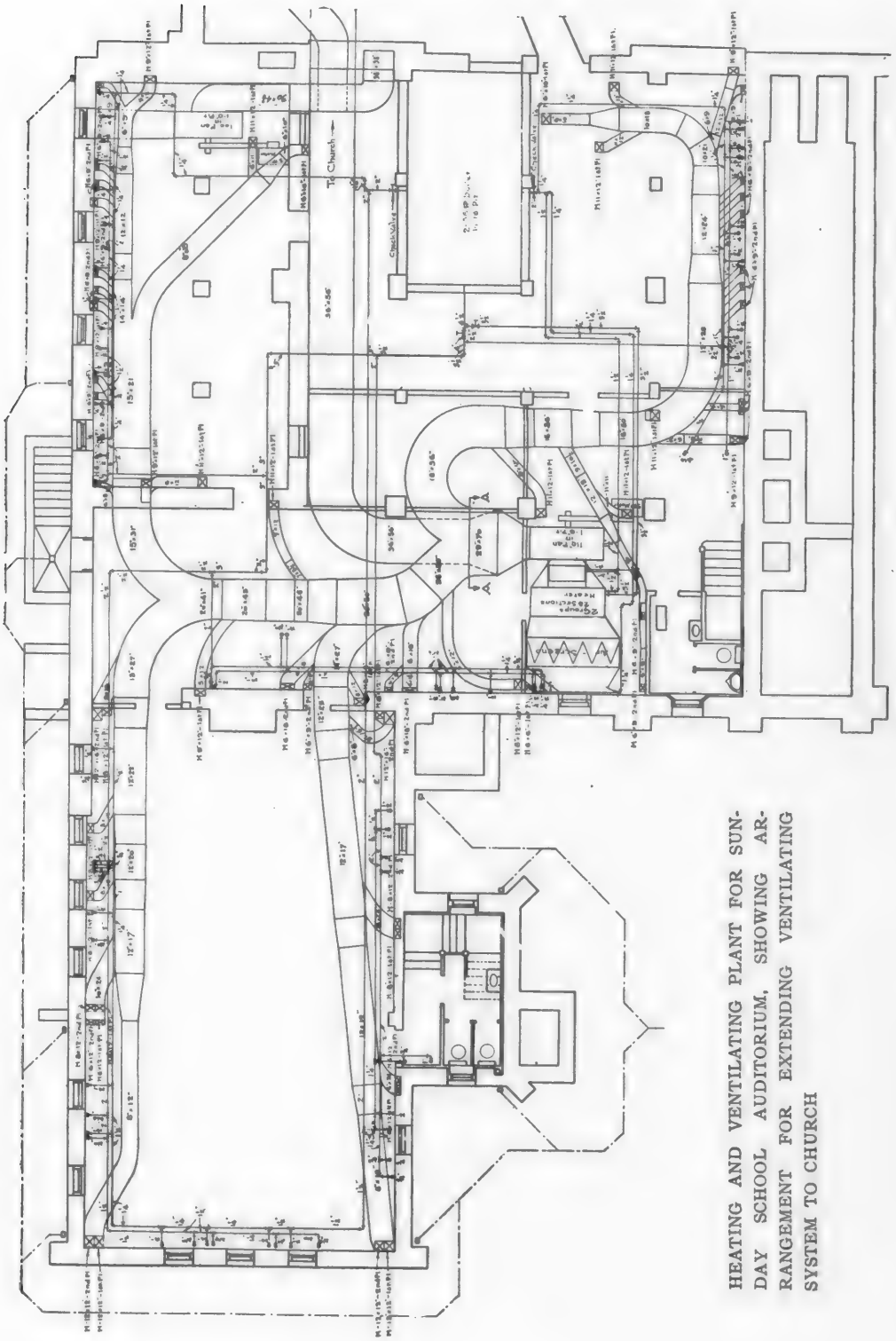
Some part of the building is in use almost daily during the cold weather and heat has to be maintained in the various rooms almost continuously. Ventilation is required for a short period of time during occupancy. The heating, therefore, is accomplished by direct radiation and the ventilation by an entirely separate plant which can be operated or not, as desired.

The air for ventilating is taken from the outside and passed successively through screens for removing the dust, thence through tempering coils and a humidifier. It is then driven by a fan through the fresh air ducts into the various rooms. The air is tempered in this manner to about 80° F. It is admitted to the rooms near the floor lines, the registers being placed just above the baseboards. These inlets are so arranged with deflectors that the air is carried down toward the floor. The velocities are arranged not to exceed 200 ft. per minute.

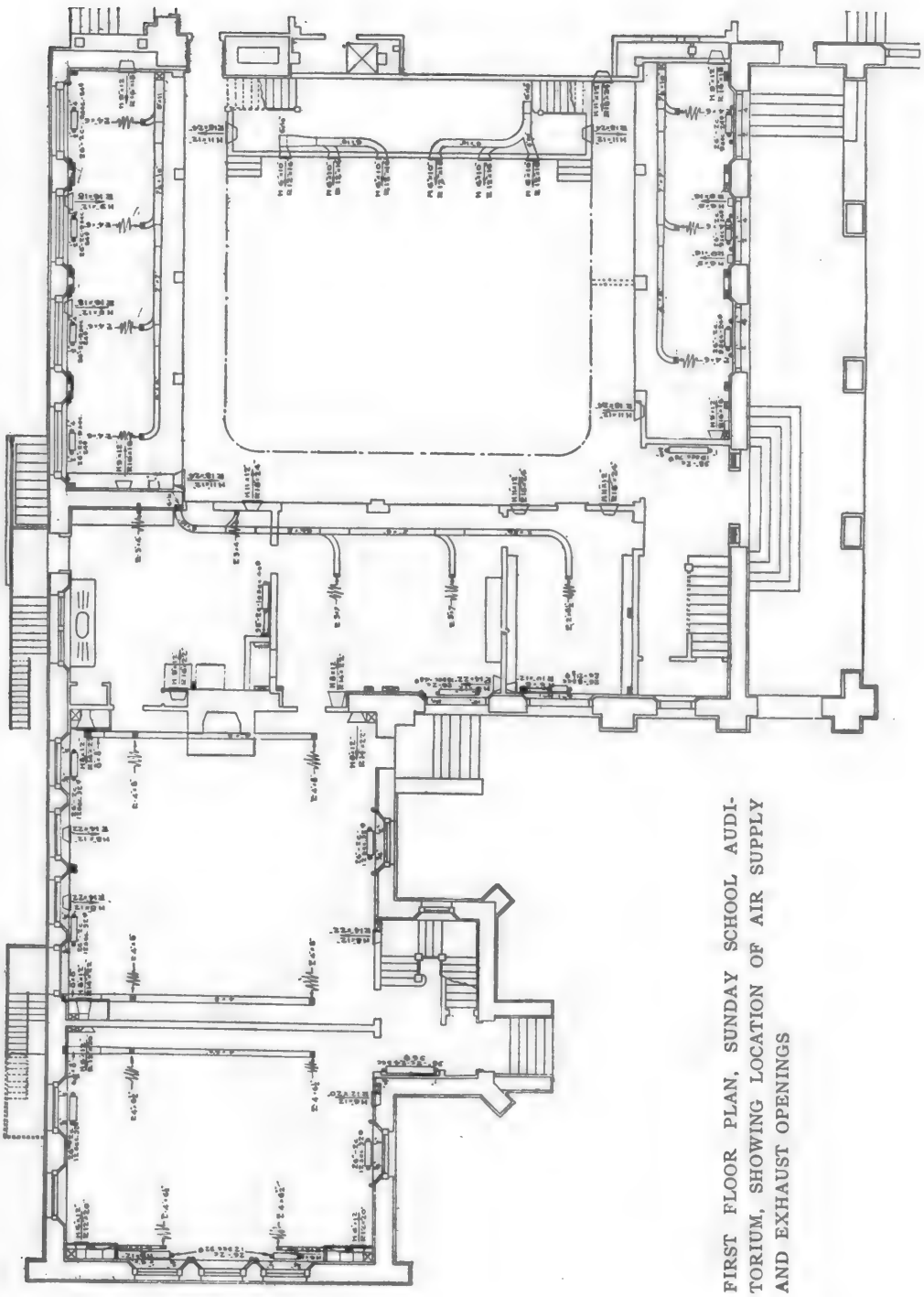
The vitiated air is exhausted at the ceiling by means of a full-housed steel plate fan connected by ducts to the various outlets. The velocity of air through the vent outlets is about 1800 feet per minute. The outlets are arranged so as to draw air evenly from all parts of the room. The volume exhausted is about 80% of the volume of the air supply, 20% being allowed for ordinary leakage.

Automatic control of the temperature, both for the heating and ventilating, is accomplished by means of thermostats. The thermostats are located in the main auditorium and are so arranged that at a temperature of 67° F., the heat from the direct radiation is cut off. At 69° the heat from one tempering coil is cut off and at 71° the heat from the second coil is cut off. These temperatures are taken in the auditorium and not in the ducts or elsewhere.

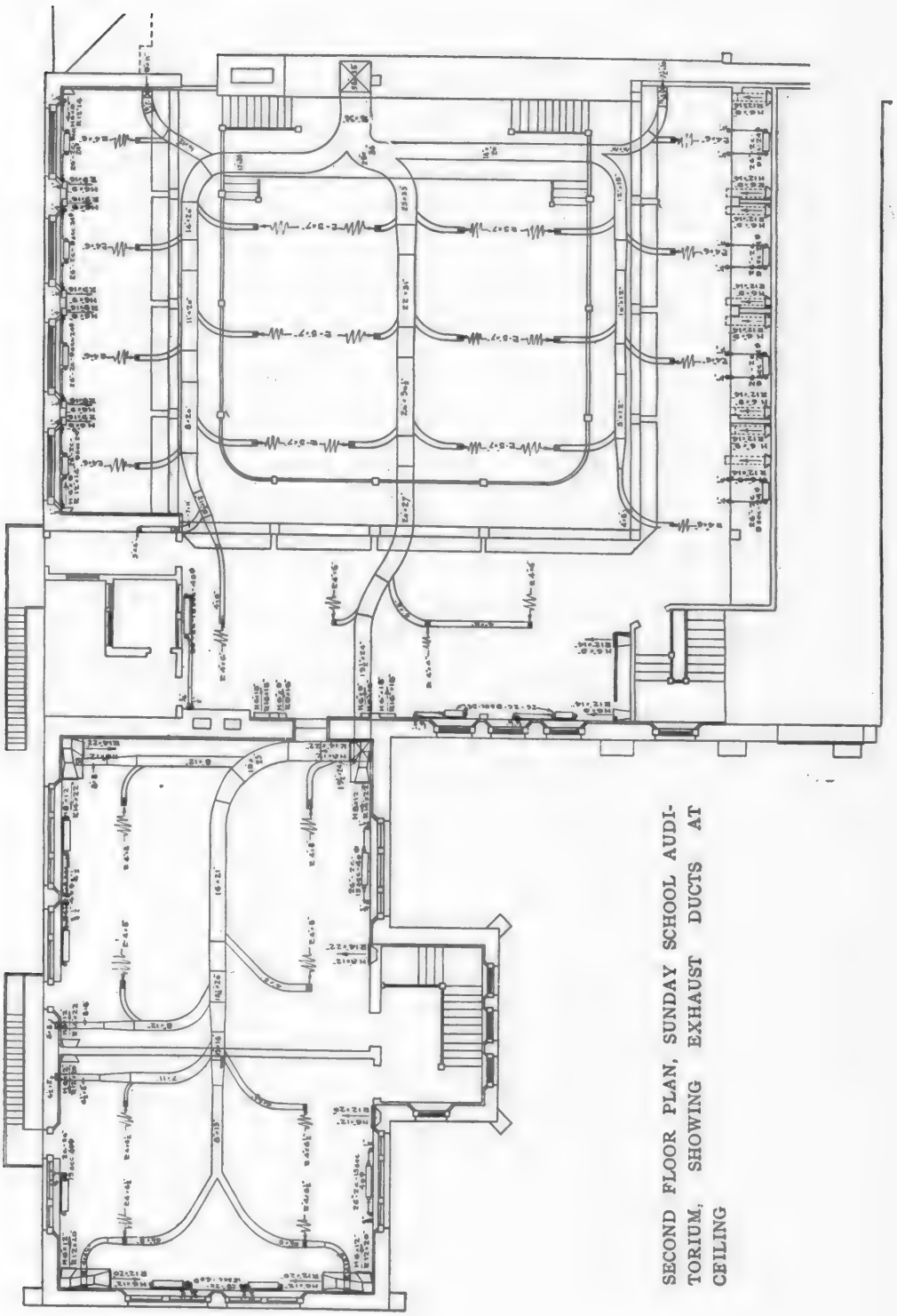
In order to maintain the outdoor condition of the air supply, the humidifying apparatus is designed to maintain a relative humidity of 60%. This apparatus consists of coils of steam pipe placed in a tank of water which is automatically supplied by means of a float valve. The steam in the coil is controlled by a humidistat which is located in the auditorium, so that the humidity supply is governed by the condi-



HEATING AND VENTILATING PLANT FOR SUNDAY SCHOOL AUDITORIUM, SHOWING ARRANGEMENT FOR EXTENDING VENTILATING SYSTEM TO CHURCH

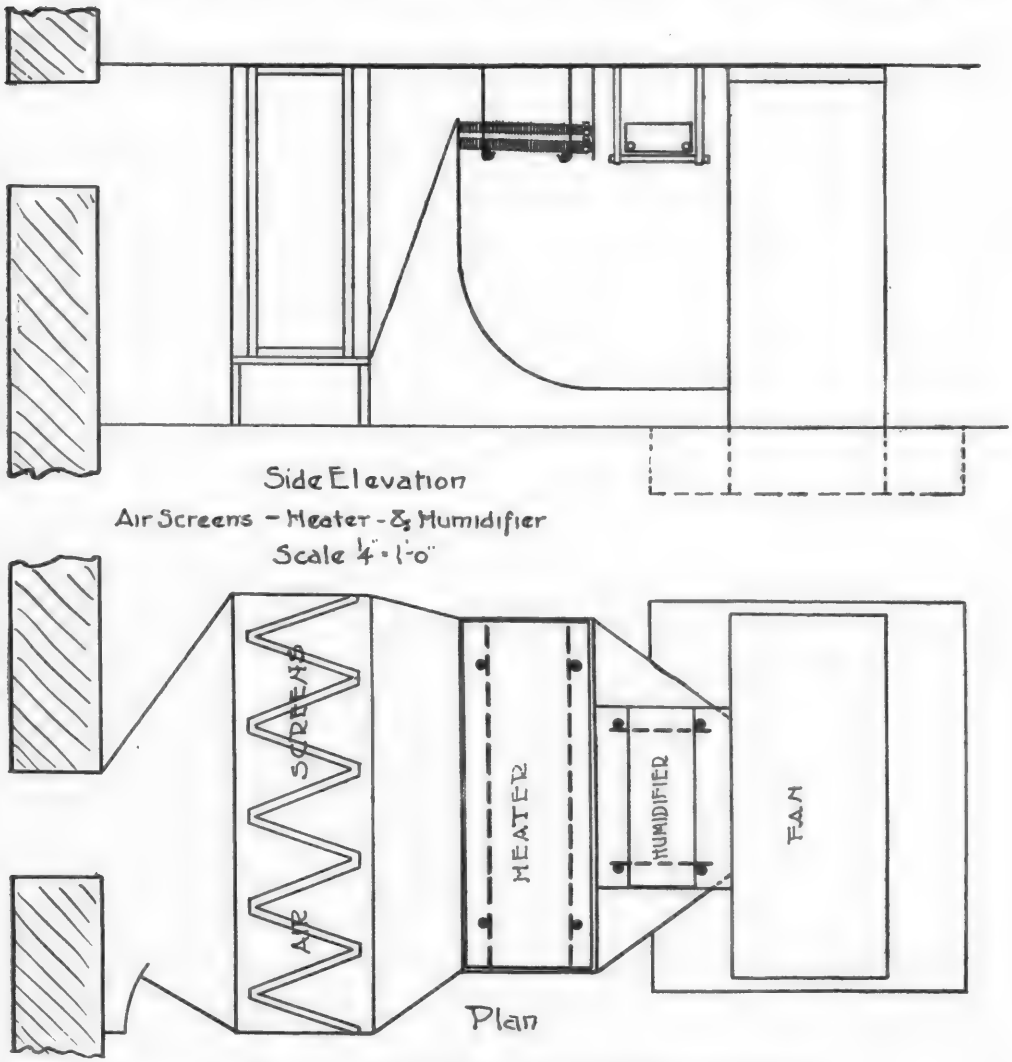


FIRST FLOOR PLAN, SUNDAY SCHOOL AUDITORIUM, SHOWING LOCATION OF AIR SUPPLY AND EXHAUST OPENINGS



SECOND FLOOR PLAN, SUNDAY SCHOOL AUDITORIUM, SHOWING EXHAUST DUCTS AT CEILING

tions in the room occupied, rather than in the air chamber between the heaters and fan or elsewhere. The idea both with the temperature and humidifying control apparatus, was to have the control exercised in arate room. The plans for heating and ventilating necessarily included methods for warming and ventilating these rooms individually, as well as forming a part of the general scheme for ventilating the en-



DETAILS OF HEATING AND HUMIDIFYING SCHEME

the atmosphere of the room occupied.

SPECIAL ARRANGEMENTS WHEN PARTS OF THE MAIN ROOM ARE SHUT OFF

During the session of the Sunday School, the spaces under the balcony are occupied by classes and, by means of sliding doors, each class room is made practically into a sep-

tire room when thrown into an auditorium.

SYSTEM MAY SERVE SUNDAY SCHOOL OR CHURCH, AS DESIRED

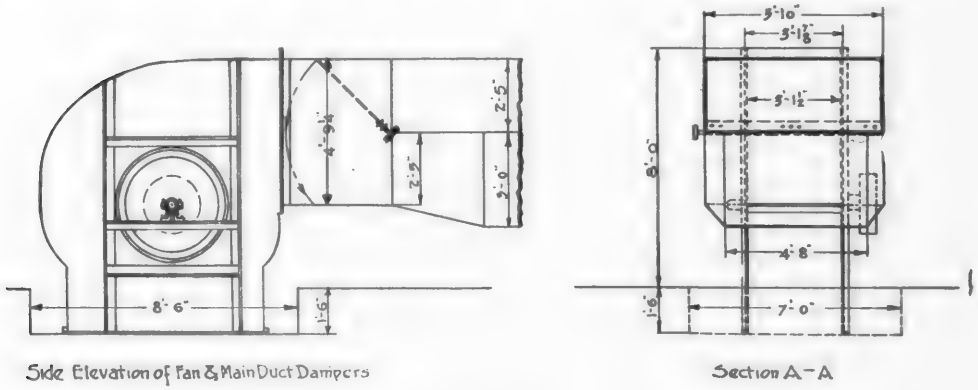
It was desired, when the installation was made, to have it designed so that it could serve for the Sunday School portion of the building or for the main church auditorium,

immediately adjoining. It was necessary, therefore, to connect both the supply and exhaust fans to both sections of the building and so equip them that by operating a damper in the main duct connected to each fan, the plant could be put into service in either portion of the building. The plans for the supply fan show how this was accomplished. The larger damper shown is balanced by weights and connected with a switch operated by the thermostatic system, so that by throwing off two switches, the supply and exhaust fans can be put into service in either part of the building. Duplicate sets of thermostats and humidostats are placed in the church auditorium so that the control of temperature and humidity is alawys exercised from the part of the building which is using the system.

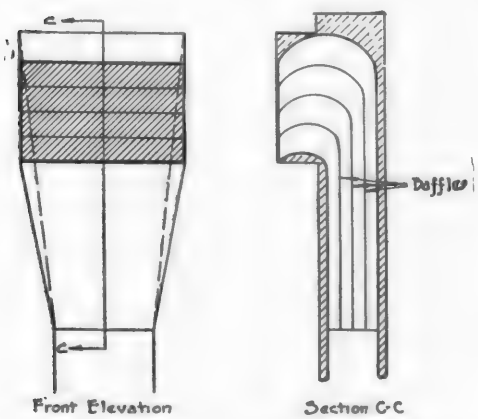
The plans also show the scheme of the distributing ducts. The basement plans contain the supply ducts while the exhaust ducts are shown on the second floor plan, the outlets for both the supply and exhaust being indicated on the drawings.

The exhaust fan, it will be noticed, is placed in the basement. The reason for locating it there was that no suitable place could be found for it in the attic and because connection could more readily be made from the church auditorium without the use of an additional unit.

The system was designed by Twombly & Henney, of New York. Mr. David Henney, who is a councilman of Montclair, had direct charge of the work, which, as stated, is characterized by those familiar with its operation as one of the most effective ventilating systems to be found. The contractor for the heating and ventilating work is Lewis Butterfield, Orange, N. J., and for the sheet metal work, O'Rourke Sheet Metal Works, Newark, N. J. The architects of the building, which is a recent addition to the church proper, are Price & McLanahan, Philadelphia, Pa.



FAN ELEVATIONS SHOWING DAMPER ARRANGEMENT FOR DOUBLE DUCT



ARRANGEMENT OF BAFFLES IN AIR SUPPLY DUCT AT REGISTERS

Drying Apparatus*

By H. C. Russell

It is not the purpose of this paper to discuss the drying of any particular kind of material, but rather to call attention to some of the principles underlying the design of drying apparatus in general. Drying is usually a process in manufacture and in such cases the dryer is generally located in the factory with a view of entailing as small an amount of extra handling of material as possible.

The manner of constructing the drying tunnels or compartments, the amount of air to be circulated, the temperature of this air, and indeed almost every detail of design depends upon the material to be dried and its amount. For different classes of material these details will vary over a wide range. Some materials are very sensitive as regards air conditions in the dryer and others will stand considerable abuse.

It is one of the underlying principles of many kinds of dryers, and applies with peculiar force to the drying of lumber and such materials, that the hot air to the drying tunnel must be admitted close to the "hot" or "dry" end of the tunnel, and discharged at the "wet" or "green" end.

It will be observed that there will be a wide difference in relative humidity of the air between the hot end and the opposite end, usually called the "green" and, because of the moisture the air has absorbed (it being the sole function of the dryer to absorb moisture). There will likewise be considerable difference in temperature between the two ends because the heat required to evaporate the moisture, supply radiation losses, etc., is usually taken from the air supplied by the fan.

If now the green material, especially such materials as lumber, should be first placed in the hot end of the dryer where the air is hot and very low in its relative humidity, the rapid evaporation and consequent drying of the surface would cause surface cracks or checking, since practically all materials contract more or less in drying.

On the other hand, if the green material is placed first in the green or wet end of the dryer where the temperature is lower than at the other end, and what is more important, the relative humidity is much higher, the drying at first will be very slow, giving the material a chance to get at a uniform temperature throughout and the drying process will begin at the centre even before it begins at the surface, because the very moist air will prevent nearly all evaporation from the surface until it is moved farther along the dryer into regions of lower relative humidity. This is the method used in a large percentage of dryers.

As each particular class of dryers has certain peculiar features which make it different from all others, it is beyond the scope of this paper to deal with them, except perhaps to say that the material may make its trip through the dryers loaded on trucks, in trays stacked on cars, on conveyors or in perhaps half a dozen other ways as best suited to the particular proposition in hand. Dryers of this class are arranged to receive the fresh material at the so-called green end, the material being gradually advanced toward the hot end as the dried product is removed from the dry end and fresh material put in at the green end.

There are other classes of dryers where the air conditions may just as well be kept about the same at all times and in all parts of the dryer. In such cases the air may be distributed in a fairly uniform manner throughout the dryer. There are still other classes of dryers in which a full charge of green material is put

* From a paper read at the annual meeting of The American Society of Heating and Ventilating Engineers, New York, January 23-25, 1912.

in. The fan is then started and the temperature gradually raised and varied at will. In such dryers, of course, the air conditions will be practically the same in all parts of the dryer at any time.

The drying compartments or tunnels, as they are often called, vary widely in design and are usually arranged with certain manufacturing conditions in view as well as the efficiency of the dryer. These manufacturing conditions need not and should not be allowed to impair the efficiency of the dryer. As a general rule, dryers for a particular class of work will be found to be about the same length, that is, if they fall under the first class of dryers named above, and the difference in capacity required will be made up in width of two or more dryers installed. For the last two classes of dryers the shape of the drying compartments is not so important, and they will be found to be made in a variety of shapes.

The size of the compartments will, of course, depend upon the amount of material, time required for drying and the space required for a unit quantity of material. The construction should naturally be fairly non-conducting, at least as much so as the best class of building construction, to avoid unnecessary waste of heat by radiation.

TEMPERATURES REQUIRED

It has been found that for practically each material the maximum temperature in the dryer for good results should not exceed a given figure and for temperatures much below this figure in the hottest part of the dryer the capacity will either be reduced or the material will not dry at all. Some of these temperatures are given in tabular form hereafter.

DRYING PERIOD

For each material there is a minimum drying time which, of course, varies very widely for different materials. If we try to extract the moisture from any given material in much less than this time we will get unsatisfactory results due to too rapid evaporation. Some drying periods are given in tabular form hereafter.

HUMIDITY

It will generally be found when hot air is first brought into contact with the material which is almost dry (the air gradually absorbing moisture as it passes along toward the wet end of the dryer and the fresh material) that no trouble will result from too rapid evaporation unless the air supply is too great or the temperature too high.

Generally if one bases his calculations on about 60% relative humidity at 50° F. outside temperature he will be safe, because when the outside temperature is below 50° one can dry with a smaller volume of air due to the fact that the moisture absorbing capacity of the air will be greater, and when the temperature rises above 50° the relative humidity will likely be lower than 60%, or the temperature of the dryer may be increased somewhat. The relative humidity and temperature can, of course, be calculated from the above assumed conditions. At the green end the relative humidity, of course, differs greatly for different classes of work. Very seldom can it be made to exceed 75% at the temperature of the air leaving the dryer.

MOISTURE

The amount of moisture to be evaporated in a unit of time must always be known for intelligent design. This can be found by simple experiment if in no other way.

AIR SUPPLY

Between the temperature of incoming and outgoing air there must be sufficient heat given off to take care of the following heat losses: (a) radiation from the dryer, (b) heat required to raise the temperature of the products to be dried, the water to be evaporated and the trucks, etc., from factory temperature to dryer temperature, (c) heat

required to evaporate the moisture based upon the latent heat of evaporation at the temperature at the wet end of the dryer. The air may be safely admitted to the dryer at a temperature above that given in the table hereafter to offset all losses except the last named.

There are two rquiremnts as to air volume which must be met: (a) there must be a sufficient volume of air as a vehicle for carrying sufficient heat to provide for all the above heat losses without reducing the temperature at the green end too low for good results, (b) there must also be a sufficient volume of air to carry away the moisture without coming too near the point of saturation. This latter is to be calculated on a basis of the difference in the amount of moisture contained in a cubic foot of air as delivered to the dryer and that contained in the same air as it leaves the dryer, the relative humidity at the green end never to exceed 75%. We should remember that most tables giving the amount of moisture contained in air at various temperatures and for various percentages of relative humidity refer to a cubic foot of the mixture of air and vapor and that the number of cubic feet of air (comparatively dry) going into the dryer may or may not be even approximately the same as the number of cubic feet of the mixture of air and water leaving the dryer.

It is imperative to see that both the above conditions as to the amount of air circulated to carry away moisture be fulfilled. I have noticed that most of us are rather inclined to overlook the second condition; and in a large percentage of the cases, this condition requires more air than the first. It is evident that the dryer is most economical which satisfies both these conditions and overdoes neither, and this is the condition sought for as near as practicable. For instance, we may discharge a large volume of air into a dryer resulting in a small temperature loss and a comparatively low relative humidity at the wet end, and it might easily happen that we can use a much smaller volume of air at the same initial temperature with a greater loss of temperature in the dryer and a greater relative humidity at the discharge end and get results just as good or even better and certainly be more economical in the use of steam.

LOSS OF TEMPERATURE

After allowing for all heat losses except those required to evaporate the moisture, the further loss of temprature in the dryer, of course, bears a definite ratio to the amount of moisture we can induce each cubic foot of air to carry away, which, of course, reverts back to the relative humidity at the discharge end. In the ordinary waste heat brick dryer this loss is about 100° F.; in lumber dryers it varies from 30° to 70°, and for the majority of other classes of dryers it runs from 10° to 30°.

The accompanying table gives the maximum temperatures, and in some cases the average drying period, for a few materials, which have come under the author's observation. Dryers for lumber and brick have by reason of their commercial importance been given con-

CONDITIONS FOR DRYING DIFFERENT MATERIALS

Material	Temperature Deg. F.	Drying Period, Days
Sole Leather hides	90	4 to 6
Thin leather hides	90	2 to 3
Bone glue	70 to 90	4
Skin glue	70 to 90	2
Starch	180 to 200	½
Apples	140 to 180	¼
Leaf tobacco	85	
Stem tobacco	200	
Soap	100	2
Wool	105	
Rags	180	
Pottery	120	

siderable attention and very reliable data have been secured.

In many drying installations waste heat can be utilized for the purpose. All brick and tile yards of modern design are now drying their products from waste heat derived

grom kilns cooling down after being burned, and it so happens that if the rotation of kilns is properly studied and adhered to, there is waste heat available practically at all times in about sufficient amount for drying the fresh product with a liberal allowance for waste. After all, very little of this so-called waste heat is really wasted. Much more can be accomplished in the way of adapting dryers to use waste heat, and furthermore the air can generally be drawn directly over the cooling surfaces themselves, for we are seldom interested in the absolute purity of the air supply to such dryers.

All that has been said above refers to dryers equipped with fans for providing a definite amount of air.

Dryers, of course, have long been in use which work by gravity, and it cannot be said that they were all failures. Indeed, it seems that for some work, notably lumber, they give better results than blower kilns.

The writer has seen many so-called dryers designed by some rule of thumb which gave fairly good satisfaction, but just how they did it I could never make out. The idea of the designer seemed to be to get his dryer as nearly air tight as possible, and to keep it as hot as possible, but fortunately his methods of construction were so imperfect that the air "leaked in" and "leaked out."

It is true that necessity is the "mother of invention," and the reason drying apparatus is just now in the experimental stage is seen in the fact that we are now approaching a point in our industrial development when the best and the cheapest that science and art can produce will be demanded.

DISCUSSION

PROF. WILLIAM KENT: There are some kinds of drying apparatus that consist of a cylinder which is rotated at a certain low velocity and the material is fed in at one end and dumped out dry at the other end. The cylinder may be heated at one end by fire or it may be heated by steam coils placed inside, or it may be heated only by hot air or gas that passes through. I wish the author would take up the question of, say, given a mass of material containing 1,000 lbs. of water, a maximum temperature allowable of, say, 200° F. For some materials, maybe 400° for others, such as sand, and tell us how that may be dried or heated with the greatest economy. As far as I have been able to find out, the greatest economy is when you use no air at all, provided the substance may be heated above 212° F. But as high temperatures cannot be used with some substances it is necessary, with these, to use air, but calculations seem to show that the larger the amount of air the less economical is the operation.

It would be an interesting problem to figure up, say, with 1,000 lbs. of water in a given quantity of drying material, what would be the cost of fuel or the number of heat units required with different quantities of air, different temperatures at the point of introduction of air, also with different temperatures of steam in the coils.

I came across a case the other day where a man had a sand drier made of a rectangular brick stack, probably 40 or 50 ft. high, with a number of cast-iron plates projecting like shelves from two opposite sides, the sand dropping from one shelf to another. There was a fire at the bottom and the sand was discharged near the bottom. That is the way Mr. Edison dries crushed brick at his cement works. After running the stack in this way the man took out the plates and put in a distributing machine at the top of the stack so that the sand fell down like rain. With no plates at all he got better results. That was one instance of the use of the rule of thumb where he did away with the old apparatus. I have no figures on that, but there is an enormous field for heating engineers to find out what can be done in the process of drying.

MR. WILTSIE F. WOLFE: Do you think you can dry in a vacuum, no matter what the temperature is?

PROF. KENT: I suppose so, if you take long enough and maintain the vacuum, drawing off the vapor with a pump. I have dried a piece of coal, taking 14% of the moisture out of it, by putting it in a desiccator, a closed glass vessel containing sulphuric acid, and letting it remain there for six weeks.

MR. WOLFE: According to Dr. Billings's tables for drying, he contends that it is the air that dries and not the heat. His tables give the amounts of moisture that the air will carry at different temperatures. If I remember correctly, at 57° F., the air will carry one-eightieth of its weight in water. With every 27° rise in the temperature of the air, you double its water-carrying capacity until you get up practically to 202° when the water vaporizes.

The reason that sand coming down like rain dries easily is that there is a better contact with the volume of air passing through. The great loss of heat in drying is due to the loss of contact.

MR. J. A. DONNELLY: A great deal of rubber is dried in a vacuum apparatus, by producing a vacuum in the dryer, heating with steam and evaporating the water out of the rubber and passing it into a condenser.

PROF. KENT: That is the way sugar is produced from the juice of sugar cane, by evaporating the water in vessels in which a partial vacuum is maintained.

In the operation of drying milk I have seen two large metal cylinders used that came within a few thousandths of an inch of each other. The milk was poured down in the space between the rotating cylinders and came out below the narrow space dry. It was then scraped off by a scraper. In this case the drying was done entirely by heat. There was a steam pressure in the cylinders of about 150 lbs., or over 300° F. temperature. The milk was entirely evaporated and the dried product, as scraped off, was packed in boxes and shipped, in the case I speak of, to the Japanese army.

PRESIDENT R. P. BOLTON: I happened to be observing the operation of a large lumber drying plant recently. I found closets prepared for the drying of lumber which were entirely closed up, with no air access to them at all and carrying very high temperatures.

MR. STEWART A. JELLETT: The subject of drying is a particularly broad one. I think it starts first with a study of the goods you are going to dry. I have had experience in drying a great many materials, including laundry soap and sand soap, oilcloth, brick, leather, playing cards, and you cannot apply the rule you use for drying one material to any of the others.

For example, in the case of playing cards, they are generally put through a press for the final glazing giving a pressure of some tons to the square inch. The only surface from which you can extract the moisture is the edge, which is about 1/100 of an inch thick. If you extract moisture from the glazed surface it will ruin the card. Therefore, you must screen the air, or you must be sure there is no dust to stick to the card and then you must extract the moisture from the edge. As a rule playing cards are printed in sheets which are dried before they are cut. Therefore you have to take the entire moisture from the edge of that sheet and each sheet contains a whole deck of cards. It takes some days to accomplish it.

In the case of laundry soap, the thing to do is to put a skin on it so as not to take too much of the moisture out. If you should treat sand soap that way, the minute a cake of soap was put in a bucket of water it would become soft.

If you are drying linoleums, you must study the effect on colors. If too much heat is applied to a scarlet or vermilion, it changes it to a bronze effect.

I do not believe you can dry nine-

tenths of the materials successfully without a circulation of air with the heat. With certain materials it is necessary to keep the temperature down, such as glue. If glue is heated to a temperature of 96° or 98° F., it will never dry, but will simply get soft. They do not make glue in the summer months for that reason. Glue has roughly 80% of moisture in it and after you get through with it, it must be dry enough to pulverize into powder. The drying of glue is accomplished in about 56 hours, whereas it formerly took some weeks. You have to watch the conditions, also, very carefully. As glue sets, it will stand a higher temperature. But if the temperature becomes too high, a skin will form over the glue which will hold the moisture inside.

The same thing is true of bricks. If you use too high a temperature in drying bricks, a skin will form and the bricks will crack.

Speaking generally of moisture in air, I remember one case where I was called in to investigate the conditions in a chemical works. The superintendent had been in the habit of drying in a certain way, with a network of pipes under a slate floor. He told me he had five miles of pipes in that room, which was about 150 feet square. The moisture was trickling down the walls in streams and the windows were screwed fast. I told him to open the windows and he would get more drying. In this particular case, he had temperature enough to release the moisture from the material, but it was necessary also to have sufficient volume of air to carry the moisture away.

We find all those theories combated by the so-called practical man. I had a case in New York a few years ago in connection with the drying of sand soap. After studying the matter, I suggested that instead of drying the soap, we freeze it. The people looked at me in amazement. I said, "Take that solid piece (it was 42 in. square and 28 in. high) across the street and have it frozen. Then grind it while it is frozen and do not let it stand until it has thawed." The owner tried the experiment and it was entirely successful. After being in the cold storage room, where the temperature was below the freezing point, the soap was put in the grinder. It cost less money to freeze it and then grind it than to heat it and grind it. When the owner built a new factory he put in a refrigerator to freeze his soap.

Notes on Heating of Swimming Pools

Interesting experiences in connection with the heating of swimming pools were related by several speakers at the recent meeting of the heating engineers' society in the discussion of a paper on this subject, presented by Cesar Teran (published in THE HEATING AND VENTILATING MAGAZINE for February, 1912). Among the speakers was Theodore Weinshank, who described a unique method he had adopted for this purpose with success.

"While it may be true," said Mr. Weinshank, "that there is no sure theoretical method of predetermination of loss of heat from the water in a swimming pool, still the conditions which tend to govern this loss are more or less a fixed basis of calculation. viz., the construction of the pool, the location of the pool in the building, the frequency with which the pool is in use and the average number of people using the pool every 24 hours. It has been our experience that the average loss of heat is from 2° to 5° F. and never more than 6° in 24 hours.

The pool described in the paper can be considered a comparatively small one, as the average size of swimming pools is about 20 ft. by 60 ft., with an average depth of 6 ft. The cubical contents of the pool described is 3,534 cu. ft., and to fill and empty this pool requires 10 hrs. and 5 hrs., respectively. This is too long a period for the average pool to be out of service. I have in mind particularly Y. M. C. A. buildings and other semi-public build-

ings where the pools are required to be accessible continuously.

We were called upon to design a heating apparatus for a swimming pool to meet the last-named requirements. The time limit given us was 3 hrs. to fill and 2 hrs. to empty the pool, and the filling and emptying were to be done at night. The pool in question was 22 ft. by 60 ft., with an average water depth of 6 ft., or containing about 450,000 lbs. of water.

In designing the equipment we did not use any intermediate apparatus but heated the water by means of steam injection while the pool was being filled.

Referring to Fig. 1, the water was admitted to the pool at point A, about 4 ft. from the bottom, in the middle of the end wall at the deepest end, through a 4-in. supply from the city mains under pressure through a filter. The arrangement of steam and water inlet is as shown in Fig. 2. The arrangement at point A, when used for filling the pool, was not with the intention of filling the pool with water of the desired temperature. The amount of steam used at point A was governed by the temperature of the incoming water and the rate at which it was desired to fill the pool.

After filling the pool, the valves at point A are closed and then valves B and C are opened and steam admitted at points E, E, 18 in. from the top of the water level. The arrangement of the connections at E, E, are the same as at point A. The admission of steam

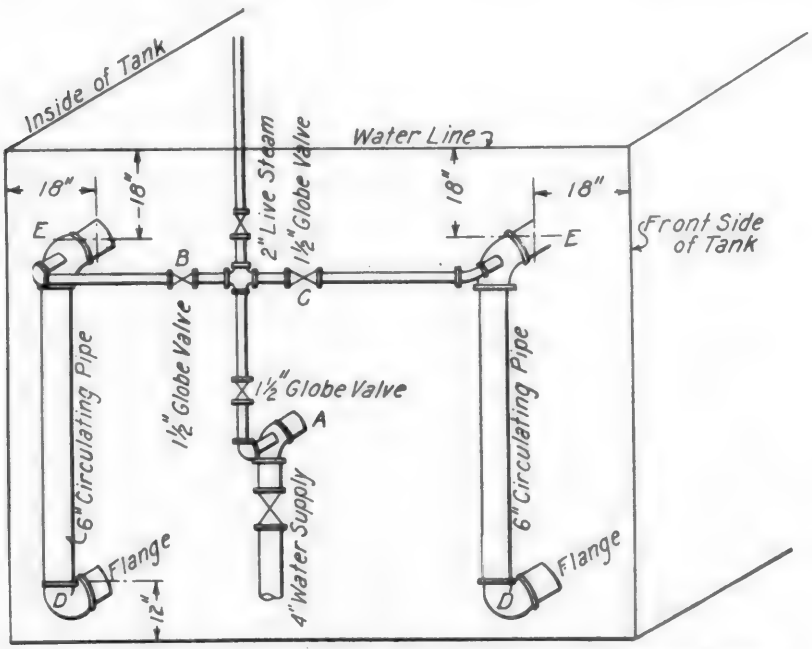


FIG. 1—PIPE ARRANGEMENT FOR HEATING A SWIMMING POOL BY INJECTION OF STEAM

at E, E, causes a circulation of water through the entire length of the pool and causes the colder water to flow through inlets D, D, upwards. By these means, we were able to bring up the temperature of the water to the desired point within a very short time.

With this design, the time limit required for heating the pool controls the boiler capacity. For example: to heat a pool 22 ft. x 60 ft. x 6 ft. from a temperature of 55° to 75° F., would require about 9,000,000 B. T. U. If this amount of heat is to be imparted to the water in 3 hrs., it would require about 90 H. P. This was the case in connection with the pool mentioned above.

A MEMBER: How about noise?

MR. WEINSHANK: We did have

noise when pipes E, E, were about 6 in. below the surface of the water. The velocity of the steam would push the water inward. We lowered the pipe about 18 in. and that overcame the difficulty.

We have installations of a similar character where cast-iron boilers under

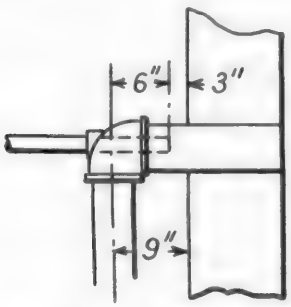


FIG. 2 DETAIL OF STEAM AND WATER INLET

low pressure are used with good results for supplying the steam to the pool.

It is stated that steam is not considered a good medium, as it will impart a peculiar odor to the water, due, perhaps, to the presence of oil in the boiler. Our experience, however, has been to the contrary.

MR. TERAN: Concerning the use of steam to heat the water, the boilers that we used were cast-iron boilers; I have an objection to feeding these boilers continuously with fresh water, as they are likely to crack. If you have wrought-iron boilers of course you can use steam.

Manufacturers of filters prefer to filter the water after it is heated on the ground that they can filter it better that way. As to the high temperature of the water used, the water is introduced at the bottom, as I stated, and no steam rises to the surface.

MR. W. M. MACKAY: I have had considerable experience with cast-iron boilers and I do not know of a single case of boilers cracking, after being filled with water, so long as the water was maintained at the proper level. I have known cases of both wrought-iron and cast-iron and steel boilers being cracked where the water was removed and fresh water turned in. I do not think cast-iron boilers will go to pieces because water is turned into them when they are generating steam.

PRESIDENT R. P. BOLTON: In planning swimming pools, I have used, for the supply of cold and tempered water, branch pipes provided with nozzles buried in the lower end of the pool, fed by a cross header laid in a trench, provided with removable perforated lids and used as a drain for the solid materials which find their way to the bottom of the pool; the trench being connected to a small sump chamber built into the wall of the pool. With this arrangement it is very easy to remove the foul materials that gather in the lower part of such pools, which is largely made up of fine hair from the body and is rather difficult to get rid of, except by thorough washing down of the surface. A channel is formed down one of the side walls on the lower end of the pool which extends down into the sump, and a suction pipe is extended down into the bottom of the sump, so that the very last drop of water can be drawn away from the floor of the pool.

Hot or cold pipes can be extended down the same chase or channel into the pipe in the trench which crosses the lower end of the pool, and thus hot or cold water, or both, may be supplied. No difficulty has been found in introducing the hottest water in that manner, even while bathers have been in the pool, because it is distributed through the nozzles and becomes thoroughly mixed with the water in the pool before it strikes the person of the bather.

MR. A. M. FELDMAN: I do not see why the author was afraid of injecting steam into the water of the swimming pool. If it is not a high pressure plant, there will be no oil in the boiler.

PRESIDENT BOLTON: This may be due to the use of a compound in the boiler affecting the character of the condensed steam.

MR. FELDMAN: I do not see why the water should be filtered after it is heated. It should be filtered before being heated so that no sediment would be carried over into the heater.

Proposed Standard Arrangements for Testing Air in School Rooms

In recognition of the recent pronouncements of medical men and other experts on the inadequacy of the carbon dioxide test pure and simple for determining the purity of the air, the following sets of conditions have been proposed by a committee on heating and ventilation of the American School Hygiene Association for use in connection with school rooms. These conditions will be made the basis of an exhaustive series of tests to be conducted in Boston by the committee of heating and ventilating school rooms of The American Society of Heating and Ventilating Engineers:

STANDARD TESTS FOR AIR CONDITIONING

A. Conditions Under Which Tests Should Be Made.

1. For all tests there should be at least two class rooms, one in which the test can be made and one for control, on the same floor of a building, and having the same conditions; that is, the apartments should be as far as possible identical in size, exposure, amount of window surface, heating apparatus, etc.

2. The children in each set of conditions should be of the same grade and in the same general physical condition.

3. In so far as is possible the pupils and teacher should not know that they are the subject of investigation, but should be led to believe that a test of the heating appaiatus is being carried on, so that no psychological factor will affect the results of tests.

4. The part of a building used as a control is to remain under the usual conditions normal to the school in which the test is made, the other room to be used only for the tests. Records on both sides.

5. A record of each child's physical condition should be taken each day and recorded on a medical chart; also a daily record should be made in both school rooms covering everything that may affect the students, such as attendance and cause of absences, reasons for referring cases to the school nurses, any local infections discovered on children's bodies, and such school-room conditions as affect the comfort, health, or efficiency of the pupils. A blank suitable for making such records should be provided.

6. All medical records and charts should be kept by trained nurses.

7. A record should be made of the size of the rooms, length, width and height, also cubic contents if irregular in shape, the number of students to each room, and the number of cubic feet of air space to each student.

8. Observations should be made in both sections at the same time, preferably at 9.30 A. M., 11.30 A. M., 1.30 P. M., and 2.30 P. M., and the records should be made by thermographs and hygrographs, and checked by thermometers and sling psychrometers. Two sets of thermographs and hygrographs should be used, one set suspended one foot below the ceiling and one set at the height of the heads of the students when sitting at their desks.

9. The standard temperature for the control room is to be 68° F., with humidity conditions usual to the building in which the test is made.

10. The instruction of students and length of hours is to be the same in both rooms each day and to follow the usual routine of the school in which the test takes place.

11. Mental tests are to be made by examinations once each week. Identical questions should be given pupils in both rooms on the same day and by the same examining teacher, who should not, if the test is oral, be the *usual* teacher of either class. The examinations are not to last over half an hour, and the examination in one room should be followed directly by the examination in the other room.

12. Each test should cover a period of three months, January, February and March.

B. Tests to Find the Effects of Temperature on School Children.

1. Test to be made in a building heated by a system of heating chambers and fans. The windows in the test room to be locked and sealed tightly. Temperature to be reduced each day one degree until 60° is reached, average humidity of the air to be about 60%.

2. Rooms heated by direct steam or hot-water radiators or stoves, the temperature is to be reduced one degree each day until 60° is reached, humidity to be about 60%. Room to be cooled by fresh air admitted from open windows and ventilators. Air to be humidified by evaporation pans over heating apparatus.

D. Tests to Find Effect of Fresh Air on School Children.

1. To obtain the results of flushing school rooms with fresh air. Rooms in which tests are made should have direct cross ventilation from windows thrown open both at top and bottom to their widest extent on opposite sides of building. Flushing should be made for a period of 3 minutes while the children are either out of the room or are exercising, the total time consumed being 5 minutes. Flushing to be done after each lesson period.

2. To obtain the results of open air class-room conditions without the effects produced by feeding and rest periods usual to open-air school. Test room to be entirely open on one or more sides, and the children to be clothed as is usual in open-air schools.

In its recent annual report the committee of the heating engineers' society stated that the estimated cost of making the tests on the plan outlined would be $8,000, not including the cost of necessary alterations in heating plans.

The committee reported that it had made arrangements for the carrying out of tests in one of the school buildings in Boston. These tests, the committee stated, are now under way and will be described in a report to be made to the society at a later date by Mr. Eveleth, the member of the committee in direct charge of the tests. Arrangements are also being made with the school authorities of a town near Boston to have a test carried out in one of their school buildings.

In New York conferences have also been held as to the method of procedure in undertaking the proposed tests. It is planned to take one or two buildings of the letter H shape in which the two ends or halves are served with separate apparatus and place one part of the building under one condition, and the other part of the building under another condition. For instance, half of the building is to be operated as usual, without humidification, while the other half is to be provided with a system of artificial humidification. In another building, half is to be left as usual, while the other will be sumbitted to a varying temperature never exceeding 70°, but for brief periods while the pupils are active, the temperature will be dropped to 50°, and then returned to 64, 66 or 68°, as may be determined. Other tests under consideration are, to try a less temperature in some of the buildings, and still others a diminished supply of air.

The greatest difficulty confronting the committee in New York was the method of determining the results of these experiments. It was the consensus of opinion that the principal of the school, the teachers and even the janitor, should be kept in ignorance of the nature of the experiments under way, and that the results should be measured by the weight and health of the pupils as recorded by the visiting nurses, all absences due to ill health to be investigated as to their nature and cause. The effect of the different conditions was further to be observed through the records of the pupils' standing in their studies during the current year compared with last.

The schools selected for the purpose of experiments are those having pupils of approximately the same grade.

The heating engineers' committee is composed of Frank Irving Cooper, Chairman; Charles F. Eveleth, Herbert G. Whitten, D. D. Kimball and C. B. J. Snyder.

THE HEATING AND VENTILATING MAGAZINE

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"BACK to Nature," a phrase that has assumed almost the dignity of a slogan among some of the progressive ventilation enthusiasts, was a deeper cut than even they realized, for it meant the open window and the lopping off of the tail of a mechanical ventilation system at a point corresponding to that immediately behind the dog's ears. While the fallacy of the argument might be evident to anyone who would stop and think a bit, it remained for those outside of the profession to show the lack of logic in the cry. As one speaker has stated, such a proposition is as unreasonable as it would be to conclude that because our water supply is sometimes dirty, we should wreck our aqueducts and dig wells in our back yards. "All along the line," he added, "civilized man is improving upon Nature and there can be no question that when we determine just what quality of air we need, it will be feasible to supply that kind of air to the occupants of rooms by mechanical devices."

As another speaker has put it, every time a man puts up a wind shield or an umbrella over his head, he is improving upon Nature. "Think of the dreadful conditions," he says, "with the thermometer below zero and a 40-mile wind blowing. We can improve on Nature there. So with the thermometer at 110° F., as I remember it on a terrible day in a moist climate, when it seemed impossible to live, much less to do anything, because we could not get rid of our body heat, it was perfectly feasible to improve upon Nature. Man has also improved on the fur of Nature. He can live near the Pole or he can live on the equator. No animal in the world can compete with him in this respect. By means of fire and cooking we have so changed Nature that we can eat almost anything. And is not the great achievement of human kind exactly that thing?"

FEW people have had more experience in the operation of ventilation systems, as regards the effect on the air in the rooms ventilated, than Dr. W. Gilman Thompson, of New York, whose illuminating remarks at the recent heating engineers' meeting, in connection with blood pressure tests which he had been making in hospitals, caused so much comment. It is a pleasure to announce that Dr. Thompson has drawn on his entire experience of some twenty-odd years in this connection in an article he is preparing on "Ventilation Problems in Hospitals and Schools," the first installment of which will appear in THE HEATING AND VENTILATING MAGAZINE for May.

MECHANICAL EQUIPMENT

The Art of Vacuum Cleaning

II.

A PRACTICAL DISCUSSION OF PRESENT METHODS AND APPLIANCES

By Austin H. Hart

(Continued from March issue)

From the experiences of various engineers in experimenting with vacuum cleaning systems, it has been found that in large buildings the risers should be from 2 in. to ½ in. standard pipe, with Durham or sanitary long-sweep fittings, with clean-out plugs, at all turns. Horizontal mains should be 2½ to 4 in. pipe, according to the number of sweepers to be operated at a given time. In residence and small installation of one-sweeper plants, 2 in. horizontal mains and 1½ in. will be sufficient size, these pipe sizes being based on the use of a system in which a vacuum of from 6 in. to 15 in. is maintained.

VOLUME OF AIR AND AMOUNT OF VACUUM

Architects and engineers through the country seem to be at great variance as to the amount of air to be handled per sweeper and the vacuum to be used in cleaning. Among the inexperienced, it is usually customary to call for a one, two or three sweeper plant and let it go at that. This means nothing in the way of volume of air to be actually displaced or the amount of vacuum to be maintained in the system, as each manufacturer of vacuum cleaning machinery will figure on a different volume of air per sweeper and a different vacuum to be maintained, the result being that possibly two systems are offered, each known as a two-sweeper plant, the actual air displaced of one of the systems will be 20 cu. ft. of free air per minute while maintaining a vacuum of 5 in., and the other 60 cu. ft. of free air per minute while maintaining 10 in. vacuum, so that although both plants are termed two-sweeper plants, one of them is over four times as large as the other.

Were the engineer or architect, in furnishing specifications for a boiler-plant, to require that a boiler should be installed with sufficient capacity to operate two steam engines, without information as to the size of the engines, it would be quite as reasonable as specifying that a vacuum cleaning system should be installed with sufficient capacity to operate two sweepers, and undoubtedly the result obtained in the long run would be quite as satisfactory.

Every architect, engineer or owner in requesting a proposal for furnishing a vacuum cleaning system, should distinctly state in the specifications the number of cubic feet of free air to be exhausted per minute for each sweeper while maintaining such vacuum as he deems proper and advisable for the cleaning to be done. When such specifications are made, every bidder submitting a proposal in the matter would base his price on performing and meeting certain specified conditions and would guarantee the actual horse power required to perform such work. Only under these conditions can the figuring on vacuum cleaning installations be put on a business basis and the owner's interests properly protected. The architect or engineer in charge of the installations would then be in a position to compel the contractors installing the vacuum cleaning system to

live up to and properly perform the conditions of such specifications.

The point which now arises is to decide upon a given volume of free air to be actually displaced per minute per sweeping tool while maintaining the proper vacuum to be used.

The Engineering Department of the U. S. Government as well as a number of prominent engineers and architects in the country have made exhaustive tests in connection with vacuum cleaning, and from these tests, together with six or seven years' experience in operating plants, they have found that 40 cu. ft. of free air per minute should be exhausted for each cleaning tool while maintaining 12 in. vacuum, or 50 cu. ft. of free air per minute per cleaning tool, maintaining 9 in. vacuum, or 60 cu. ft. of free air per minute while maintaining 6 in. vacuum.

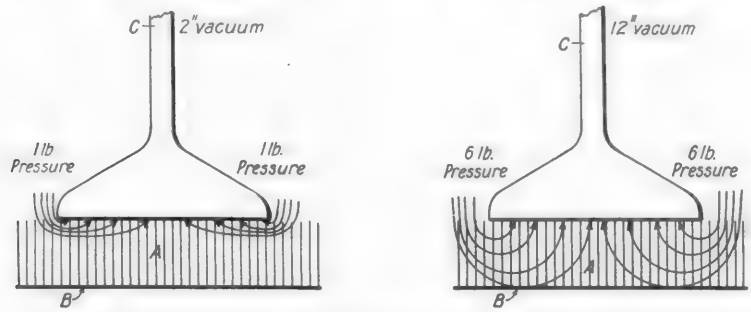
The above being known as high, medium and low vacuum systems. The high vacuum is used where the cleaning is in the nature of heavy carpets, rugs, rapid cleaning of large areas of wood floors and where the buildings are large and the pipe-runs from the exhauster to the various outlets are of considerable length.

Medium vacuum is used in smaller buildings with comparatively short runs of pipe and where less rapid and thorough cleaning is desired.

The low vacuum is used where the horizontal runs and risers are very short and service required of the system is very light and intermediate, being more in the nature of a duster than a thorough cleaner.

In view of the fact that these results have been obtained after extensive investigation and years of experience, it seems almost unnecessary to go into the matter further.

However, quite recently a number of manufacturers of vacuum cleaning machinery have stated that, it is not necessary to have an exhauster maintain over a few inches of vacuum to do perfect cleaning, as it is merely a question of displacing a large volume of air. In truth, the producing of a vacuum will clean nothing. It is merely the rush of air over and through the fabric that picks up the dust and dirt and does the cleaning, but this rush of air into the sweeper or tool is caused by maintaining a vacuum in the system so that the atmospheric pressure causes the inrush of air. The higher the vacuum, the more rapid will be this inrush of air and the greater the volume of air passing through the sweeper or cleaning-tool.



FIGS. 1 AND 2—COMPARISON OF COURSE OF AIR THROUGH NAP OF CARPET WITH LOW AND HIGH VACUUM

A—Nap of Carpet B—Warp of Carpet C—Cleaning Tool

For instance, if a vacuum of 12 in. is maintained in a system there will be an atmospheric pressure of 6 lbs. forcing the air through the fabric into the tool. If 2 in. vacuum is maintained there will be but 1 lb. atmospheric pressure, having just one-sixth the power to pick up the dust and dirt in the fabric to be cleaned.

To clean the dust and dirt which has settled through the nap to the warp of carpets and rugs and in cracks of wood floors, it is absolutely necessary to have high atmospheric pressure to dig down, as it were, into

the fabric or cracks to remove such dust and dirt. With a low vacuum system, the surface only is cleaned or rather dusted.

In low vacuum systems where large hose is used and the outlet to which this hose is attached is but a short distance from the exhauster, we find a very considerable volume of air will rush into the hose or cleaning appliance attached thereto when the same is held open to the atmosphere.

However, as soon as we place this appliance on a heavy and dense carpet or smooth floor the appliance is practically sealed and the inrush of air ceases. This is due to the fact that the vacuum maintained in the system is so low that the atmospheric pressure is not sufficient to force the air drawn into the nap of the carpet or cracks of the floor, picking up the dirt and carrying it up through the appliance. The sketches (Figs. 1 and 2) below illustrates this more fully.

Arrows show the course of air under various vacuum conditions.

Under the low vacuum system with a displacement of 100 cu. ft. of free air, while maintaining 2 in. of vacuum, we would find that not over 5 cu. ft. or 10 cu. ft. of free air at the most would enter the cleaning tool when the same was placed on a carpet, there being only 1 lb. atmospheric pressure, under the high vacuum system with a displacement of 40 cu. ft. of free air, while maintaining 12 in. vacuum, the entire 40 cu. ft. of air would be forced through the cleaning tool under similar conditions, by atmospheric pressure of 6 lbs.

We believe this illustration will readily convince the most skeptical how impossible it is to obtain satisfactory results from any system in which a low vacuum is maintained.

Of course, it is necessary to have a given volume of air to get results in cleaning and carry away the dirt and the reason for specifying 40 cu. ft. of free air per cleaning tool per minute, while maintaining 12 in. vacuum, is due to the fact that 40 cu. ft. of free air is practically the amount of air that will flow through 75 or 100 ft. of 1 in. vacuum hose, when 12 in. vacuum is maintained on the system and, as it is usual to have from 75 to 100 ft. of hose attached to appliances in general cleaning, the specifying of an amount that will cover the capacity of the hose is most proper.

By increasing the size of the hose, we may increase the volume of air passing through the same, but we must still maintain a high vacuum, to effect thorough cleaning as above explained. With 40 cu. ft. of free air rushing through a standard 12 in. or 18 in. sweeping appliance, while 12 in. to 15 in. vacuum is being maintained in the system, ideal cleaning results are obtained.

Furthermore, it is absolutely necessary to maintain a high vacuum in buildings where there is more or less piping as the friction of the air passing through the pipes is very considerable. It is immaterial what the displacement of the exhauster may be, if sufficient vacuum is not maintained to overcome this pipe friction, in that, especially in the case of fan, centrifugal and rotary types, they will merely churn and practically exhaust no air when connected with a very considerable piping system.

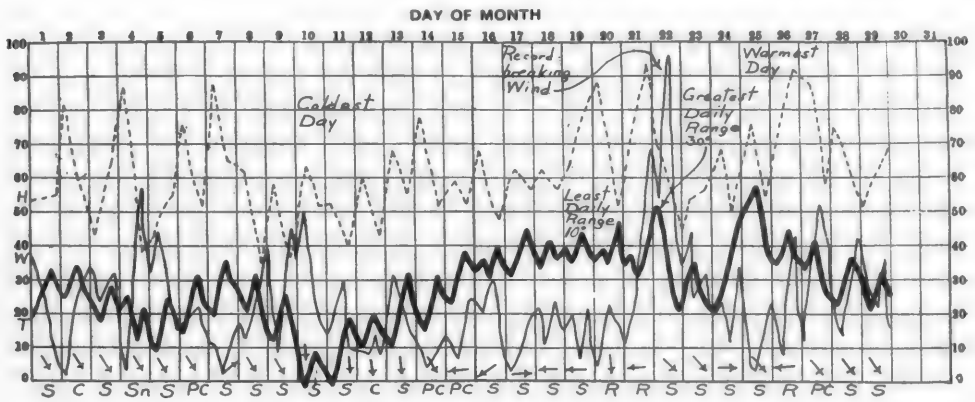
Generally speaking, in a building of 10 or 12 stories and up, it requires a 5 in. or 6 inch vacuum to overcome the pipe friction alone, when a considerable volume of air is to be exhausted, without taking into consideration the additional vacuum maintained to cause the proper inrush of air to the tool.

Any standard table showing frictional losses for compressed air through pipes, may be used in figuring the frictional loss of air through pipes under vacuum, in that the viscosity of air does not change under various pressures or vacuums, the frictional loss being constant according to the size and length of pipe and volume of air passing through the same.

(*To be continued*)

The Weather for February, 1912

	New York	Boston	Pittsburg	Chicago	St. Louis
Highest temperature, degrees F.	58	57	57	50	59
Date of highest temperature	25	22	26	18	18
Lowest temperature, degrees F.	—2	—1	—9	—7	—7
Date of lowest temperature	10	10	10	4	4
Greatest daily range, degrees F.	30	33	25	19	25
Date of greatest daily range	22	22	13	17	3
Least daily range, degrees F.	10	6	8	5	5
Date of least daily range	19	26	7	12	21
Mean temp. for month, degrees F.	28	28	25	22	28
Normal mean temp. for month, deg. F.	30.7	28	31.8	25.4	33.5
Total rainfall, inches	2.06	2.38	1.8	1.57	2.8
Total snowfall, inches	1.8	0.2	8.3	9.9	21.2
Normal precipitation, this month, inches	3.87	3.56	2.75	2.16	2.86
Total wind movement, miles	14603	8651	8081	10040	7952
Average hourly wind velocity, miles	21	12.4	11.6	14.4	11.4
Prevailing direction of wind	N. W.	S. W.	West	West	N. W.
Number of clear days	12	14	9	7	4
Number of partly cloudy days	11	4	5	10	7
Number of cloudy days	6	11	15	12	18
Number of days on which rain fell	4	6	14	6	7
Number of days on which snow fell	1	2	11	6	4
Snow on ground at end of month, inches.	None	None	Trace	3.7	Trace


DAY OF MONTH
Coldest Day
Record breaking Wind
Warmest Day
Greatest Daily Range 30°
Least Daily Range 10°
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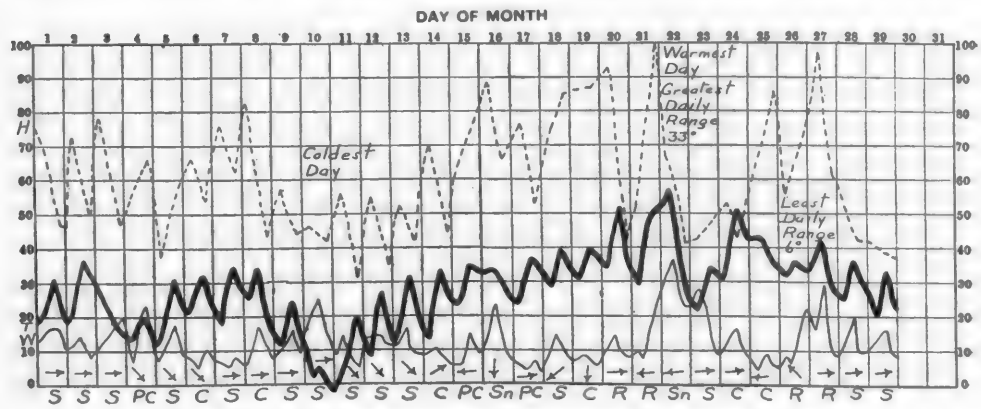
RECORD OF THE WEATHER IN NEW YORK FOR FEBRUARY, 1912


DAY OF MONTH
Warmest Day
Greatest Daily Range 33°
Coldest Day
Least Daily Range 6°
H
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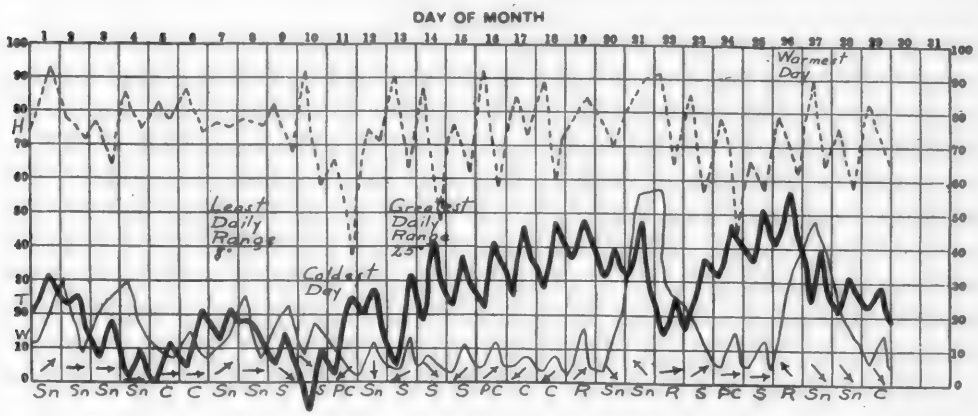
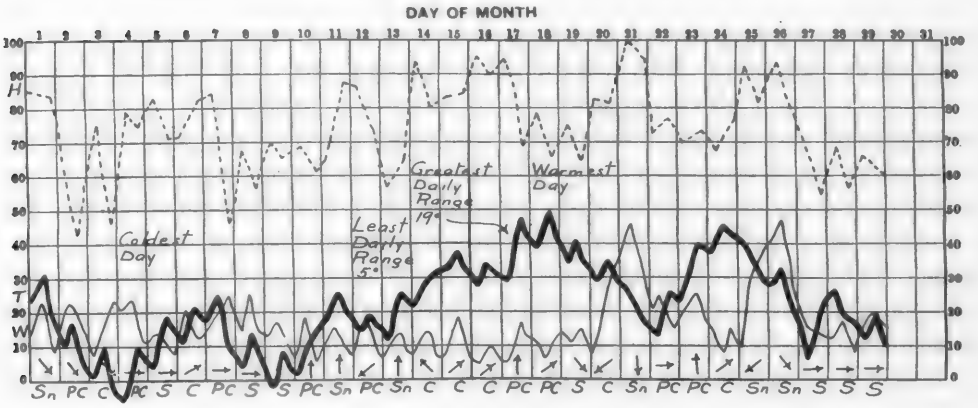
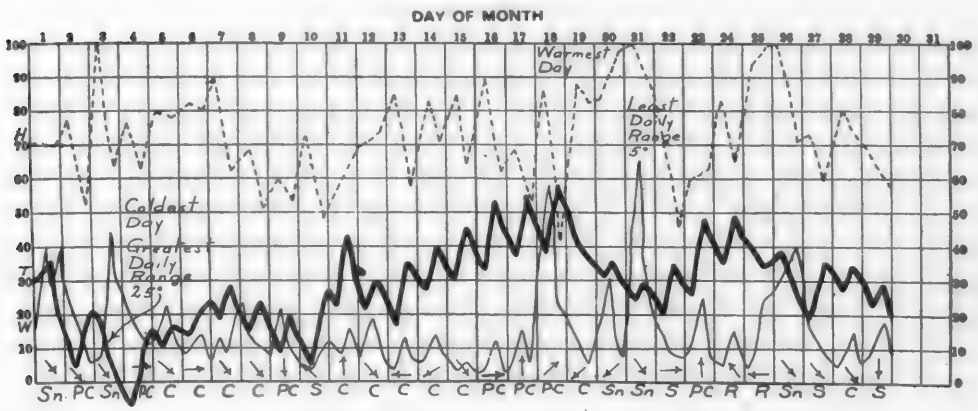
RECORD OF THE WEATHER IN BOSTON FOR FEBRUARY, 1912



RECORD OF THE WEATHER IN PITTSBURG FOR FEBRUARY, 1912



RECORD OF THE WEATHER IN CHICAGO FOR FEBRUARY, 1912



RECORD OF THE WEATHER IN ST. LOUIS FOR FEBRUARY, 1912

Plotted from records especially compiled for THE HEATING AND VENTILATING MAGAZINE by the United States Weather Bureau.
Heavy lines indicate temperature in degrees F.
Light lines indicate wind in miles per hour.
Broken lines indicate relative humidity in percentage from readings taken at 8 A.M. and 8 P.M.
S—clear, P C—partly cloudy, C—cloudy, R—rain, Sn—snow,
Arrows fly with prevailing direction of wind.

Current Heating and Ventilating Literature

Under this heading is published each month an index of the important articles on the subject of heating and ventilation that have appeared in the columns of our contemporaries. Copies of any of the journals containing the articles mentioned may be obtained from THE HEATING AND VENTILATING MAGAZINE *on receipt of the stated price.*

AIR WASHER AND COOLER, CAR

Air Washer and Cooler, Santa Fe Train de Luxe. 500 w. 2 figs. Ry. Age Gaz. Jan. 5, 1912. 20c.

HEATING

Heating and Ventilating of Court House. Illustrates and describes details of mechanical equipment used in heating and ventilating this pubic building at Memphis, Tenn. 1800 w. Met Work—Jan. 19, 1912. 20c.

FACTORY HEATING

Special Requirements in Factory Heating. H. C. Russell. Considers methods of meeting particular requirements. 1500 w. Met Work—Jan. 19, 1912. Serial. 1st part. 20c.

HEATING WITH GAS ENGINE EXHAUST

A Heater Utilizing the Hot Gases Exhausted from a Gas Engine. 700 w. 2 figs. Eng. News. Jan. 18, 1912. 20c.

MECHANICAL EQUIPMENT

The Mechanical Equipment of Department Stores. Percival R. Moses. 2000 w. 3 figs. V—Deals with equipment for ventilation. Isolated plant. Jan., 1912. 20c.

VENTILATION

Humidity and Ventilation in Cotton-Weaving Sheds. Reports results of the committee appointed to investigate conditions and report on means for improving them. 5500 w. Engng—Jan. 12, 1912. 40c.

Tests That Show Rise in Body Temperature With a Wet-Bulb Temperature of 65° F.

For the first time, the effect of a hot, damp atmosphere, pure and simple, upon the temperature of the human body has been studied on a large scale. The results of the investigation are contained in a report of the departmental committee in England on humidity and ventilation in cotton-weaving sheds.

The work of the committee was inaugurated in 1907 as the result of complaints received from the operatives in the cotton-weaving sheds of Lancashire, England, that they suffered from bodily discomfort, lassitude, want of energy, enervation, and injury to health from the hot, moist atmosphere in which they are compelled to carry on their work.

The committee issued a preliminary report in 1909, but the present report contains its final conclusions on the subject. In its first report, the committee stated that it was clear that the hot, moist atmosphere in the sheds in which the weavers work caused bodily discomfort during the hot summer months. That it caused injury to health, however, was not proved, although, as the committee said, inferences might be drawn from the evidence. The evidence to which the committee referred was that of distinguished physiologists who were unanimous in recommending that when the wet-bulb temperature of the air within the sheds reaches 75° F., all artificial humidification of the air should cease, for an increase of the wet-bulb temperature above this point would cause an increase of body temperature.

The committee's latest conclusions, as contained in its final report, are that exposure to a wet-bulb temperature of 65° F. within the cotton sheds raises the body temperature and accelerates pulse and respiration.

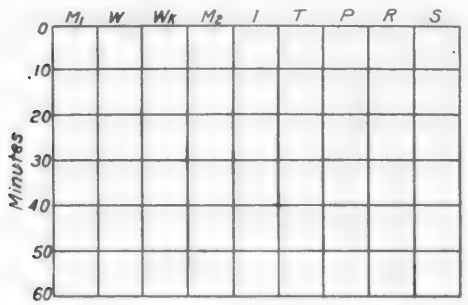
The report contains the records of 237 observations of the body temperature of weavers at their ordinary work within the humid cotton sheds. Of these, the mouth temperature of 61.7% was found to be increased and of 9.2% unchanged.

Another table contains details of the mouth temperatures, pulse-rate and respiration rate, and the atmospheric conditions within the sheds. The few given herewith cover a range of wet bulb temperature of the air within the sheds from 80° F. to as low as 65° F.

Atmospheric Temperature in Sheds. Deg. F.		Body Temperature Deg. F. in Mouth	Pulse	Respiration
Dry Bulb	Wet Bulb			
88.0	80.0	100.0	108	16
87.0	79.0	100.4	108	24
85.5	78.0	99.6	96	28
85.0	77.0	100.4	126	24
84.5	77.5	100.3	130	22
84.0	77.0	100.3	84	25
83.0	75.0	99.3	92	16
82.0	76.0	99.2	88	14
81.0	75.0	100.0	92	22
80.0	75.0	99.2	92	28
79.0	73.5	100.2	110	24
78.0	73.5	100.0	100	30
77.0	73.0	100.1	100	18
76.0	72.0	99.4	88	20
75.0	69.5	100.2	110	18
74.0	70.0	100.0	98	22
73.0	67.0	99.0	80	16
72.0	67.0	99.6	93	—
69.0	65.0	100.0	100	26

Time-Table for Observing Work of Mechanics

The accompanying chart will enable an employer to make a study of the time consumed by his employees in doing various classes of steam-fitting work. It was prepared by Norman A. Hill to illustrate his discussion of efficiency in labor, published in THE HEATING AND VENTILATING MAGAZINE for February, 1912. In describing the chart, Mr. Hill said: "Take ordinary cross-hatched paper that has ten square to the inch. Insert headings on it as shown in the accompanying figure. M_1 means measuring, W



M_1 - Measuring
W - Waiting for Helper
M_2 - Measuring
I - Instructions to Helper
T - Preparing Tool
P - Pipe Cutting
R - Pipe Threading
S - Pipe Fitting

CHART FOR OBSERVING WORK OF MECHANICS

is waiting, Wk is walking, for the men walk around with a lot of pipe, and so on; M_2 is for remeasuring, I is for instructions, T is preparing the tool, that is, the actual time consumed in oiling, etc.; P is the time consumed in cutting the pipe, and S is pipe fitting. The nine things here set forth are susceptible of material increase in efficiency. I believe that heating contractors can increase the efficiency of their men from 30% to 50%, and pay them a portion of that inrease.

Each chart is designed to cover the operations of one man and his helper during one hour. Your observations of a workman for one hour may be recorded by blocking off the necessary number of squares for each operation. For instance, if the workman takes 20 min. for measuring, two of the squares should be blocked under M_1, etc.

Heating Guarantees

Your committee would recommend that the designer of apparatus should be considered responsible for the results to be obtained by its use, provided it is installed and operated as designed and intended; and that the contractor should only be held responsible for the installation of the apparatus in the time agreed, with materials specified, in exact conformity with the design and specification, and such materials and labor as he may furnish in placing the apparatus, and that any guarantee which the contractor may be called upon to give, covering the installation, completion and materials and labor furnished, should not extend for a longer period than one year from the time of completion and permanent operation of the apparatus.

The question of what guarantee or assurance, if any, the designer should give the owner is one that would depend somewhat on existing conditions. If it were in an old building and the designer was thoroughly familiar with its construction, exposure and tightness, he would reasonably be expected to guarantee the successful operation of his work.

If, on the other hand, he were called upon to design apparatus for a building not yet constructed, he could reasonably assume that the building would be well constructed, and any defect in the construction of the building which interfered with the successful operation of the apparatus designed by him for a well-constructed building should be chargeable to the architect, owner or building contractor, and not against the designing engineer.—*Substance of report of the committee of heating guarantees, presented at the recent annual meeting of the American Society of Heating and Ventilating Engineers.*

Needed Information on Heat Transmission with Indirect Radiation

Recent discussions of heat transmission with indirect heating surface, notably that aroused by Frank L. Busey's recent paper read before the heating engineers' society, have brought out the fact that there are some points still to be covered before the engineer will be in possession of all the necessary data on this subject. Speaking on this phase of the matter, Prof. William Kent said: I would like the author to supplement this paper, if he will, with a brief summary of the important results obtained and of the conclusions derived from them. I would like to know, for example, what are the conditions necessary to heat a given quantity of air to a given temperature.

The results to be obtained by any air-heating apparatus are two in number: (1) Quantity of air in pounds or in cubic feet, measured, say, at 70° F.; and (2) the final temperature desired.

To obtain these results we have three features of construction or design: (1) Type, cast iron or wrought iron; (2) square feet of heating surface; (3) free area, square feet, for the passage of air.

There are also three conditions of operation: (1) Temperature of steam; (2) initial temperature of the air; (3) humidity of the entering air.

I would like to have Mr. Busey give us a statement or formula showing the relation of these six variables to the two desired results.

A MEMBER: Should not friction effect be one of the factors?

PROF. KENT: I think friction will be a function of the velocity, that is, the quantity in cubic feet divided by the free area, and also of the quotient of the square feet of heating surface divided by the free area.

Humidity and Health

As a boy I used to enjoy "staying around" the kitchen after studying in my own room. Often, since then, I have tried to analyze this boyish liking. Was it due merely to the change of surroundings, the simple companionship, or to the pleasant excitement of what was going on? To be sure, my eyes were rested from their books, my ears were entertained and my mind relaxed by the homely discussions of that part of the house; moreover the "smells" aroused other sensations common to growing youth.

Even now I experience like refreshment in going to the kitchen, and I have come to the conclusion that this partiality for the kitchen, rather than the study, was due to the contrast in the air of the two rooms. The study was probably dry, whereas in the kitchen the steam from the tea kettle and the water evaporating from the cooking softened the air and gave an agreeable feeling to the skin.

I was annoyed by drying and cracking of the lips and remembered especially how sore they were often on cold winter days in a country church. Evidently this was due to the variety of atmospheric conditions through which I passed. Before leaving home I would have spent most of the morning in the kitchen. The change was very marked from the moist air there, and the cold, moist outside air immediately following, to the air of the church, where moisture was all sucked out by the rapid heating of the cold building. The contrast of moisture and dryness following close upon that of heat and cold was so sharp as to irritate the lips which are highly sensitive, and left them cracked and sore.

Later, on moving from the Central West to a dry Northern State, I found the atmosphere trying. The skin often had a parched feeling, and the dryness of the lips was a constant annoyance. This effect was so marked that after four years I felt I must get away to a moister climate. I had a sense of nervous tension and dreaded passing another winter in the State.

Early in December came my opportunity to move away, and on my journey eastward I spent a day in Chicago. As I walked along the lake front the "feel" of the cold, wet air, raw though it was, was one of the most refreshing sensations I ever experienced. I then realized that the improvement I had felt throughout the day was due to the presence of an increase of moisture in the air.

In less than two weeks after my arrival on the Atlantic coast I gained 10 lbs. in weight. Of course the change in surroundings and of food, and the stimulus of new conditions, had much to do with this improvement, but something about the climatic change was certainly a strong contributing factor.

Women appreciate the effect of climate upon the skin and complain that residence in certain localities is hard on their complexions. A literary man, after a year of residence in an arid State, quite shocked his friends upon his arrival in an Eastern city by the way he stared at the women he passed on the street. He seemed almost dazzled by the difference between these faces and the parched faces of the women in the region he had left. The remarks of this man, with his trained sense of observation, were both entertaining and illuminating. He was surprised to find himself "surrounded by such young women; women where I've just come from are so much older than women of the same age here." He had come from a region where the annual rainfall was 10 in. to one where it was four times as great, and the air had on this account a much higher percentage of moisture, or, more technically, a "higher humidity."—F. W. GOLDSBURY, M. D., in the *Boston Medical and Surgical Journal.*

The Mystery of Temperature Regulation

BY VERNER F. DAVIS

Of the numerous parts of which a modern heating and ventilating system consists, none is clothed with as much mystery and misunderstanding as the automatic temperature control system. This has been caused partly by the intricacy and complicated mechanism of the original thermostatic system, but the principal reason has been the attitude of the manufacturers toward the buyers and users of temperature control.

When temperature control first came into existence the manufacturers very foolishly assumed an attitude toward the public similar to that of physicians and lawyers toward laymen, placing themselves, as it were, behind a screen, disregarding standards entirely, using special screw threads and sizes, with the idea, no doubt, that they were entitled to make all repairs. Even the artisans

who were skillful enough to adjust a thermostat were referred to as experts.

The reader can imagine the result of this unfair and unbusinesslike attitude and the very unsatisfactory operation of the apparatus, where it was necessary to depend upon thermostat experts perhaps hundreds of miles away for the adjustment of a screw or valve, or for the replacing of some small part which had become worn. At that time the heating industry was in its infancy and there were a number of defective heating plants installed throughout the country. In a great number of cases, these defects in operation were blamed on the automatic temperature control, and, to a certain extent, the same condition obtains even today.

At the present time, however, this condition has partly changed and the successful manufacturers of automatic temperature controlling systems have brought the various parts of the apparatus to a standard, making it possible for the operating engineer or janitor to make simple repairs and to do whatever adjusting is necessary.

A number of people are of the opinion that on account of the work expected of the thermostat, it must be a very delicate instrument. This is not true, for while a thermostat must be a very sensitive instrument, it does not necessarily have to be a delicate one. When one considers the thousands, and, one might say, millions of people who are benefited by a constant indoor temperature throughout the the heating season, obtained in no other way than with a thermostat, one must admit that automatic temperature control is a benefactor to mankind, and it is unfair to condemn any part of the regulating apparatus, when in the majority of cases where there is trouble, it lies in the heating plant or in its operation.

Recently one of our more or less prominent men, writing in criticism of the present methods of ventilation of schoolhouses and taking issue with one of the most efficient engineering forces in the country, referred to the thermostat as an "instrument of the devil." Unfortunately, this is the opinion of some people, who do not seem to realize that a thermostat has nothing to do with the admission of fresh air or the exhausting of foul air, and is in no way responsible for the ventilation of any room. Its sole duty is to turn on and off the heat when the temperature is above or below the point at which it is set.

The writer has observed that in numerous cases where there has been complaint made of the operation of the thermostat in cold weather, there has not been sufficient steam pressure to warm the building, and, on the other hand, has found upon investigating other complaints in mild weather that the outdoor temperature has been above the desired indoor temperature.

These complaints must be answered intelligently and politely. Too often it is left to a mechanic of small intelligence to rectify the trouble, and he has no interest outside of earning a day's pay with as little effort as possible.

A publicity bureau is needed to educate the people in the use of temperature control, its advantage and purpose, and the sooner the manufacturers get together and organize, the better it will be for the public, the architects, the engineer and themselves.

Temperature regulation has had to improve to keep abreast of the times and to fulfill modern requirements, but what publicity has been given to the improvements? Practically none. Salesmen's talks and explanations and catalogue literature are looked upon as trade arguments, and do not go very far to edify the people who are interested.

In this enlightened age of automatic machinery, is it not foolish to claim that any system of temperature control is so perfect that it does not need to be explained? Organized publicity is the solution, for the clerk or office boy as well as the most eminent architect or engineer is entitled to know as much about the thermostat in his office as he does about the electric light or radiators.

Legal Decisions

Waiver of Lien by Tender of Note

In an action to foreclose a mechanic's lien for the installation of a heating plant in the defendant's residence under a verbal contract, an unsecured note was agreed to be taken for part of the balance due on the completion of the work. The Washington statute, Rem. and Bal. Code, Section 1143, provides that the taking of a promisory note or other evidence of indebtedness for any labor performed or material furnished, for which lien is created by law, shall not discharge the lien therefor, unless expressly received as payment and as specified therein. It was held that the agreement that the note should be received in part payment for the work implied a waiver of the lien which would give the maker of the note the right to so specify therein. The defendant offered to give a note on completion of the work, which was refused. The court held that the tender of the note precluded the plaintiff's lien.—Ward vs. Thorndyke, Washington Supreme Court.

Liability for Damage Caused in Shutting Off Heat

The tenants of ground-floor rooms in a three-story brick building sued the owner thereof and a heating company for damages to a stock of undertaking goods, alleged to have been caused in the following manner:

The heating company owned and operated a central hot-water heating plant. Immediately above one of the rooms occupied by the plaintiffs was a suite of office rooms. In 1903 the heating company, under a contract with the owner of the building, installed therein, except in the premises occupied by the plaintiffs, a heating system of pipes and radiators. The heat was brought into the basement by an inflowing pipe, and the return line was by an outflowing main, also in the basement. A short time prior to February 8, 1905, the defendants were notified by the new occupants of the office rooms to cut off the heat, which they undertook to do. It was also averred that in cutting off the heat the defendants negligently shut off the entire circulation of water in the office rooms and neglected to draw the water from the pipe, creating a "dead end" in the pipe at which the water collected. On February 8, 1905, this water froze and burst the pipe, causing large quantities of water to flow into the plaintiffs' premises. The heating company was held liable for the damages, and the owner not liable. In carrying out its heating contract, the company owed, not only to the patrons in the building, but to all rightfully therein, the duty of care commensurate with the danger to which it exposed them, and was liable for damages to the plaintiffs by the freezing of the pipes caused by its negligence.

The sufficiency of the evidence to sustain the verdict in favor of the owner of the building presented the most difficult question raised by the appeal. The owner and the heating company each hoped to shift the liability or to be relieved therefrom by the application of the same rule of the law of agency. The heating company contended that the proof showed that their general superintendent, Thrush, in giving instructions and directions to Miller, an employee of the owner of the building, as to how to shut off the water, was acting in the service of the owner. He, on the other hand, insisted that his employee, Miller, was loaned to the heating company to shut off the water, under the instructions and directions of its general superintendent, Thrush. Considering the evidence, the court thought that the jury might have properly found that the duty of shutting off the water from the office rooms rested upon the heating company, and not the owner; that the heating company accepted Miller as their agent, and authorized him to shut off the water, and instructed and directed him how to do so; and that the instructions and directions were wrong, with the result that the water was shut off in the negligent manner charged. There being some evidence tending to prove such facts and inferences, the court held the verdict of the jury as to the owner sustained by sufficient evidence.—Peru Heating Company vs. Lenhart, Indiana Appellate Court.

CORRESPONDENCE

Champions Vapor Heating

Editor HEATING AND VENTILATING MAGAZINE:

We do not feel competent to judge Mr. D. M. Quay's communication in your February issue relative to vacuum pumps on heating jobs, but we know he is mistaken when he calls an air line system with two check valves on its end a "fake" system. We have installed systems of this kind that give better results than any air line system with a vacuum pump on it that we have built. We are also advised of other contractors who have had similar experiences.

We have also installed vacuum pump systems designed by capable engineers to operate without back pressure, only to find that 15 in. of vacuum at the pump and 2 lbs. back pressure at the engine would not give the same results as when no pumps or automatic apparatus of any kind was used.

The heating jobs that, during the past winter, gave the most satisfaction to our customers, were vacuum vapor jobs, and we believe that every man in the heating business should get first-hand information about this method of heating.

THOS. M. CAREY.

Defiance, O., March, 1912.

Heating Conditions in Winnipeg, Canada

Editor HEATING AND VENTILATING MAGAZINE:

Permit me, as a subscriber to your interesting paper, to jot down a few lines which may prove of a little interest to other readers. What I say must not be construed as adverse criticism of the work of the heating and ventilating tradesmen in our city of the north, but my aim is to show how needful we are of a neutral engineering economy in the science of heating and ventilating.

Situated as we are up in this cold climate (Winnipeg), the art of heating and ventilating ceases to be one of the lesser attributes of a building. We have here temperatures ranging, during the winter, from 32° F. to —55° F. Of course, this

varies from year to year, but at the same time remains constant enough to cause us to devise schemes to cope with such constant conditions. In general we may say that heating and ventilating in this city up to a year or so ago was not given a great deal of thought or attention from an engineering point of view, based on economy and first-class results.

Any building that called for a hot air furnace system were, and are as yet, furnished with a plant sold and installed by the square yard, without any regard of getting a successful return for fuel consumed. We note now, though, a few exceptions where there is a strong tendency to deal with this system of heating in residences in a scientific manner.

Coming along to steam and hot water heating, we find these systems handled in much the same manner as the hot air furnace installations, except where the job happens to be planned and specified outside the range of a petty contractor.

There is one thing that one notes, however, in the steam installations in the numerous one-pipe systems, no matter how high the building is or how cut up the apartment block. We wonder at the forbearance of the tenant or owner when we see them, on cold, frosty days, at 40° below zero, drawing off or blowing from the air valves of the radiators, two and three bucketfuls of hot water. It is needless, perhaps, to mention that, with a little more expense and a little engineering, some economy could be gained which would favor both tenant and owner.

Of course, causes for such conditions are numerous and cannot be laid at the door of blind ignorance, but, as before mentioned, to lack of neutral and scientific engineering.

Ventilation, in our city, is of necessary moment, as we are shut up and almost hermetically sealed during our coldest weather. Without it the windows would have to be opened and the result would be a stampede to get out of the draft. Very few of our buildings are ventilated, but our architects and owners have come to realize at last the extreme need of it and no doubt, before long, a little more legislation on the question will make up for the otherwise lack of interest in what is nowadays a necessary expedient of health.

I give here an example of a deformed heating and ventilating system in one of our largest and most helpful institutions and one which the writer is having changed over to a system based on the economic plan as before mentioned. The building in question is a hospital, approximately 400 ft. long by 40 ft. wide, four stories in height and exposed to all winds. The building is distant about 150 ft. from the power house.

The building was started 20 years ago and, being built, we might say, in installments, the heating system has suffered the same fate.

Two-thirds of said building is heated by a gravity circulation system of hot water, heated in two cylindrical heaters with live steam, said heaters being each 42 in. x 60 in. The basement ceiling is a mass of pipes from 1¼ in. to 8 in. in diameter.

It takes from five to six hours to heat the building after steam is turned on. The remaining third of the building has a fan blast system, without any exhaust ventilation whatever. Needless to say, there is practically no ventilation while, at the same time, the exhaust from the engines is going outboard instead of being utilized for direct steam heating.

The entire system is being changed to a low pressure direct steam vacuum heating system, with modulation valve control and complete ventilation. As this hospital has constantly from about 380 to 400 patients, one can readily understand what is needed. This is just one example of how expensive a system may be when no economic engineering has been used. But we hope now that all architects, contractors and owners will unite on this one principle of the greatest good, the squarest deal and lasting results to their clients and to the heating and ventilating following also.

WILLIAM E. COX.

Winnipeg, Canada, March, 1912.

Quantity of Air Delivered Under Different Pressures

Editor HEATING AND VENTILATING MAGAZINE:

I notice in one article in your November, 1911, issue (page 11) a statement which I think should not be allowed to pass without correction.

The statement is as follows *"Suppose this"* (the failure to consider the loss in pressure in the heating coils) *"is done with a system in which the total pressure of the fan is only ½ oz. per square inch. The loss of pressure in the heating coils might easily reach ¼ oz. per square inch, in which case only about one-half as much air would be delivered by the system as was intended."*

The mistake is in the statement, "only about one-half as much air would be delivered."

This is fundamentally wrong, and is a mistake which is made so often that it should be caught whenever it appears.

One-half the loss in pressure does not mean that only one-half the quantity of air will pass through under the reduced pressure. It means that seven-tenths the quantity of air will pass through under the reduced pressure.

The loss in pressure varies very closely with the square of the quantity of air,

and the quantity of air, therefore, should vary as the square root of the loss in pressure.

With one-half the loss in pressure, the quantity of air would not, therefore, become one-half, but would become equal to the square root of one-half, which equals 1/1.414, or 0.707, or approximately seven-tenths the quantity of air.

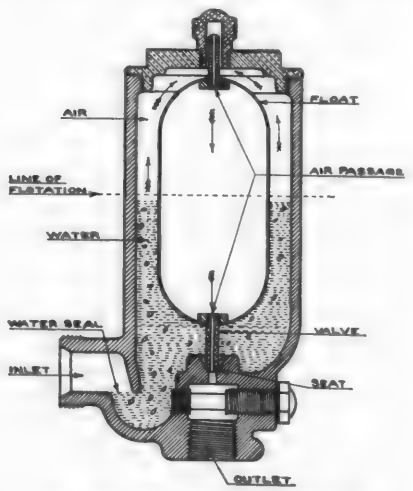
WILLIAM J. BALDWIN.

New York, March, 1912.

Float Valves for Vacuum Heating Systems

BY SPENCER CURTIS

The accompanying illustration refers to the trap or valve that is connected to the outlet or return end of the radiator or heating coils, the outlet of the valve leading to the return pipe which connects to the vacuum pump. The purpose of the trap, of course, is to hold the steam in the radiator and at the same time provide for the passage of air and the water of condensation into the return line.



FLOAT VALVE FOR VACUUM STEAM HEATING WORK

There being a great difference of pressure between the radiator and the return line, the valve must work perfectly at all times to effect the highest radiator efficiency and fuel economy.

Of the various devices used for this purpose, the two best known are the thermostatic and float type vacuum valves. In the thermostatic type the materials used are metal and volatile fluids, such as alcohol, ether, chloroform, naphtha, etc. Its principal feature is a thin-walled metal thermostatic chamber, hermetically sealed, and containing volatile liquids. The upper end of the thermostatic chamber is fixed to the cover or cap of the trap, and at the lower end is the valve seating over the return line.

In the float type metal only is used in the construction. The vital part is a hollow metal float with a valve seating over the outlet to the return line. Through the float body is a separate air passage opening into the return. At the inlet is a water seal or pocket.

The water seal at the inlet prevents the escape of steam from the radiator while passing on air and water of condensation into the float chamber. The air separating from the water rises in the float chamber and escapes continuously into the return pipe through the open air passage in the body of the float, aided by the suction of the vacuum pump and independent of the height of water in the float chamber. Water accumulating in the float chamber rises until the line of flotation is reached, causing the hollow float to lift, thus opening the valve and permitting the water to escape into the return pipe. The float chamber drained, the float sinks, reseating and closing the valve.

Among the advantages that can be mentioned for the float type of valve are the following:

Radiator air escapes continuously and independent of the discharge of water.

The water seal at the inlet prevents the escape of steam from the radiator, thereby insuring against waste of steam.

The valve opens and closes with the rise and fall of the float and the height of water in the float chamber.

Vital parts of the valve remain unaffected by constant use.

The valve action is sensitive to the line of flotation, so that the water is discharged as quickly as it enters the float chamber, thus continuously and completely draining the radiator of water of condensation.

The valve action is independent of the degree of temperature, and is, therefore, non-thermostatic.

The parts cannot wear out; therefore no replacement of parts is required.

Of course, with the thermostatic type, escape of radiator air is intermittent and dependent upon the discharge of water of condensation, and it is pointed out that intermittent valve action may cause a lessened efficiency of the radiator in heating.

It would seem, therefore, that the least possible interruption in the discharge of both air and water from the radiator should be procured, if possible, to obtain uniform and maximum heating efficiency and greatest fuel economy.

Announcement is made of the resignation of Harry de Joannis as editor of *Domestic Engineering*, of Chicago, to become the western business representative for the *Metal Worker*, with headquarters in Chicago.

Hot Water Service Tanks

It is a gratifying sign of the times to notice the greater attention that is being given, in the erection of high-class apartment buildings, to the installation of a better grade of mechanical equipment. In no respect is this more noticeable than in the installation of efficient hot water tanks for heating water for baths, faucets, sinks and all house purposes. The old-style tank, with a coil or return bend, has been succeeded, in a number of instances, recently, by apparatus such as the Patterson hot water service tank.

The shell of this tank, which is one of the types of hot water heaters manufactured by Frank Patterson & Co., 26 Cortlandt street, New York, is made of heavy boiler plate. To the bottom are riveted two close-grained gray-iron steam expansion chambers and tube plates combined. The steam enters the inlet chamber when it expands and fills all the tubes, passing through them to the outlet chamber, where the condensation is discharged and is returned by gravity to the heating boiler.

The heating surface consists of a number of Ω-shaped seamless drawn brass tubes, the ends of each tube being expanded into the tube plates and providing, on account of their shape, provision for contraction and expansion without danger of leaking.

The shells are provided with a standard manhole with yoke and cover, and are tapped and reinforced with heavy steel flanges riveted thereon for all water inlets and outlets, mud blows, return connections, for safety valve, thermometer and temperature regulator.

Being made of heavy material and being tested after assembling and made tight under a water pressure of at least 200 lbs. to the square inch, there is no danger of heads blowing out, as happens with the old-style tanks, especially when used in high buildings.

One of the reasons for the efficiency of the Patterson tanks over types of coil and tank is that all the surface is designed to be used at all times in the heating of the water. This does away with the possibility of the tubes becoming filled with condensation and the resultant decrease of efficiency, as in a coil, for it is pointed out that the condensation formed in the first bend of a coil is carried on until the last coils are filled. In the case of the Patterson heater, the condensation is discharged as rapidly as formed. There is also no possibility of leaking return bends or bursting coils, due to the condensation backing up. Tubes of small diameter are used, as they are found much more efficient in the transmission of heat than those of large area.

Some of New York's finest apartment houses, recently opened, containing the Patterson hot water service tank, are the Luxor, Aqua Vista, Bretton Hall, Reinclif Court, Wallace, Windmere, Shore View, Chautauqua, Broad View, Colosseum, Harpley Hall, Stadium View, Paterno, Sophomore, Ethelbert Court, Hanover, Graham Court, Mayfair, Porter Arms, Strathallen, Monte Vista, Rivera and Stratford-Avon.

Journeymen Steam Fitters Ordered to Join Plumbers' Organization

Acting on a recommendation passed at the recent convention of the American Federation of Labor, the executive committee of that organization has formulated a proposed amalgamation agreement whereby the International Association of Steam, Hot Water and Power Pipe Fitters and Helpers of America is to be absorbed by the United Association of Journeymen Plumbers, Gas Fitters, Steam Fitters and Steam Fitters' Helpers of the United States and Canada.

The proposed amalgamation agreement, which is signed by Samuel Gompers as president of the American Federation of Labor, provides that the steam fitters joining the plumbers' organization shall have all of the rights and privileges of that body.

The steam fitters' association has gone on record as strongly opposing any scheme of amalgamation. The efforts of the plumbers' organization to force the steam fitters to join with them was the cause of the Chicago strike of last summer, and the results of that strike have been largely influential in precipitating the present situation. A bitter struggle is anticipated before the proposed amalgamation becomes an accomplished fact.

Failure of the McCrum-Howell Co.

Acting on proceedings brought in Philadelphia and Chicago by A. E. Pfahler, of Philadelphia, who holds $310,300 in stock in the concern, receivers have been appointed for the McCrum-Howell Co., New York, manufacturers of the Richmond line of boilers, radiators, vacuum cleaners and plumbing goods. The receivers named by United States District Judge Sanborn in Chicago are Edward R. Stettinius, president of the Diamond Match Co., and Walter D. Updegraff, of Philadelphia. The same receivers have been appointed in Philadelphia by Judge Buffington, and in New York by Judge Holt.

The McCrum-Howell Co. had its main offices at 103 Park avenue, New York, with branches in various cities. Its manufacturing plants are located at Tacony, Pa., Norwich, Conn., Uniontown, Pa., Chicago, and Racine, Wis. The company was incorporated, under its present name, in 1904, with 35,000 shares of common stock and 35,000 shares of preferred

stock. The capitalization value at par was $7,000,000. Recent quotations of the stock on the Chicago Stock Exchange were as low as 2½ for the common and 10¾ for the preferred, a loss in the preferred of more than 82 points from its price of a few weeks ago.

The prosecution of the company in connection with the Government's suit against the bathtub trust, with which it was said to have been allied, is given in the complaint as one of the causes of the conditions which demanded an intervention of the court. "The company's credit," continues the petition, "has been considerably hampered. The sudden fall of the company's stock and diminishment of receipts of the concern resulted from the widely advertised prosecution by the Government under the Sherman act, in which the McCrum-Howell Co. was alleged to be a member of the bathtub trust."

In the petition for the appointment of a receiver, a financial statement of the condition of the company on April 1, 1911, was included, placing the assets at $8,387,496 and the liabilities at the same amount. A similar statement presented to the court, showing what purported to be the present circumstances of the company, and dated March 8, 1912, gives assets of $3,122,000 and liabilities of $2,118,000.

The company's main office is in charge of the receiver's assistant, J. Rice, and the business will be continued for the present.

The officers of the company were: President, Lloyd G. McCrum; vice-president, George D. Howell; secretary, Howard T. Gates; directors, officers named and W. A. Cameron, Francis R. Cooley, J. W. Curtis, C. E. Merrill and A. E. Pfahler.

New York Chapter

An innovation was inaugurated at the March meeting of the New York Chapter in the shape of a dinner at the Hotel Hermitage, Seventh avenue and Forty-second street, preceding its professional session. Thirty-three members and guests were present. The affair was highly successful, and the arrangement will be repeated at the chapter's May meeting. The next (April) meeting, however, will be held, as formerly, in the rooms of the Engineering Societies building.

The programme for the March meeting included an address by Frank G. McCann, chief engineer for the New York City Department of Education, on "The Ventilation of the New York Public Schools," and a paper by James A. Donnelly on "The Time Element in Regard to the Starting Up of House Heating Boilers." Among the out-of-town guests of the chapter were Sam Kauffman, president of the Kauffman Heating & Engineering Co., St. Louis, and Harry de Joannis, editor of *Domestic Engineering*, of Chicago.

Massachusetts Chapter

The Massachusetts Chapter is holding its regular monthly meetings at the City Club, Boston, the professional session being preceded by dinner, served at 6 P. M. The March meeting, held March 12, was devoted to "Ventilation and Humidity," the principal speakers being Frank Irving Cooper, Charles F. Eveleth and H. W. Whitten.

March Meeting of Illinois Chapter

"Tests and Studies of Large Plants, Including Plans and Specifications of Same, with Criticisms and Recommendations by the Committee," was the subject of the March meeting of the Illinois Chapter, which was held at Vogelsang's, Chicago, March 11. The committee in charge was composed of: E. L. Hogan, chairman; F. W. Powers, W. A. Green and R. B. Hayward.

D. D. Kimball, chairman for New York State of the compulsory ventilation committee of The American Society of Heating and Ventilating Engineers, will deliver a lecture on "Ventilation," at the Harlem Y. M. C. A., 5 West 125th St., New York, Thursday evening, April 11. The public is invited.

Federal Furnace League

At a recent meeting of the executive committee of the Federal Furnace League, the president of the league, William J. Myers, resigned on account of ill health. The resignation was accepted by the executive committee and the duties of president will be assumed by the vice-president of the league, A. W. Glessner, of Chicago. Wilson Ferguson resigned as secretary and treasurer of the league, so that he might devote his time to a new line of work. The engineer of the league, Dr. William F. Colbert, was elected secretary and treasurer to fill Mr. Ferguson's unexpired term. The headquarters of the league have been moved to 372 Bullitt Building, Philadelphia.

Chicago Heating and Contracting Engineers, at their annual meeting in Chicago, March 5, elected the following officers for the ensuing year: President, R. H. Thomas, Thomas & Smith; vice-president, John R. Kehm; treasurer, William Sullivan; secretary, J. M. Oleson; recording secretary, J. Mellum; execu-

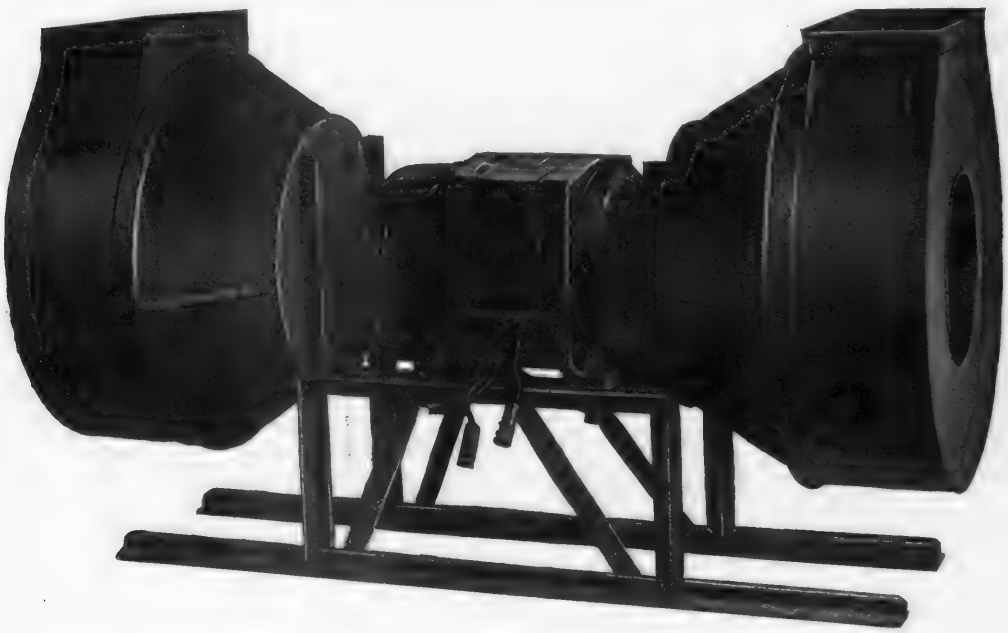
tive board, officers named and William Melony, J. J. Daly and P. M. Callahan.

Newark (N. J.) Association of Master Steam and Hot Water Fitters held its annual dinner in Newark, March 19. The new officers of the association are: President, W. A. Lawson; vice-president, L. W. Butterfield; secretary, Harry Geiser; treasurer, William M. Whitlock; member of executive committee (for three years), E. B. Denny.

NEW DEVICES

Hackney Ventilating Outfits

Hackney double blowers, with capacities ranging from 3,000 to 8,000,000 cu. ft. of air per hour each, are featured in new circular matter issued by the Hackney Ventilating Co., Minneapolis, Minn. These units are for use in connection with the Hackney double centrifugal disc blower system of sanitary electric ventilation. The accompanying illustration shows one of these blowers suspended on both ends of a single phase, repulsion type, variable speed electric motor. The company makes 29 sizes of blowers of this type, which are constructed of tank steel and mounted on the same shaft. Although usually equipped with direct-connected motors, they are also made for belt or chain drive, or are directly connected to steam engines or other available power. Other forms of construction show the openings looking away from each other, or another opening placed on the quarter where circumstances demand such connection. One blower is designed to be connected to the supply duct and the other blower to the exhaust duct. The company has reports on some interesting installations it has made, showing the success of the system, which has many unique features.



HACKNEY VENTILATING OUTFIT

Nine Talking Points for the new form of pipe covering made by the A. Wyckoff & Son Co., Elmira, N. Y., are given as follows:

1. Manufactured from Gulf cypress, the "wood eternal."
2. Unaffected by wet and dry conditions that exist in a steam pipe trench.
3. Thickness of inner shell increased to 2 in.
4. Thickness of outer shell, 1 in.
5. Dead air chamber of ¼ in. between two shells.
6. Air chamber made watertight by the use of asphaltum packing on the ends between the two wood shells.
7. Joints a driving fit, insuring watertightness.
8. Each shell wound with galvanized wire.
9. Covering coated all over with Hydrolene-B, described as the best known preservative.

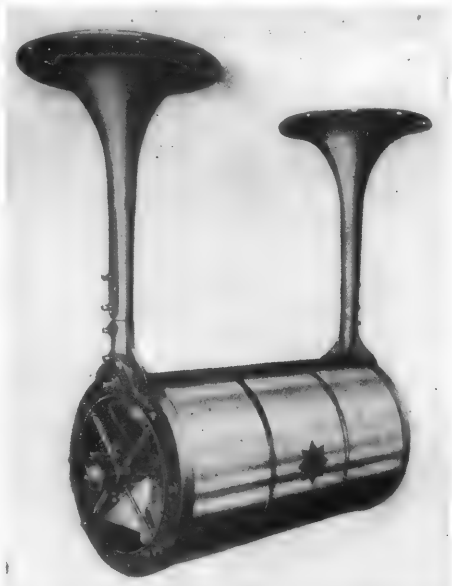
New Book

A Practical Manual of Steam and Hot Water Heating, by Edward Richmond Pierce, is a new work containing the

series of articles on the subject that have been running in Domestic Engineering, of Chicago. It is a book of 339 pages, 6 in. x 9 in., and, although it goes over much of the ground already covered by the standard authorities, it is notable for its simple and lucid treatment of the various subjects, thus bringing the problems involved within the range of the everyday workman in the heating industry. It is, therefore, without many of the usual formulas and scientific phrases. The matter of ratings for low pressure steam and hot water boilers are taken up at length, the publishers stating that one of the purposes of the book is to stimulate a desire on the part of the master steamfitters of the country to secure proper boiler ratings, which, it is stated, can be brought about to the best advantage by the efforts of the master fitters. The author shows his familiarity with recent developments in the heating industry and that feature alone adds much to the usefulness of the book to the up-to-date fitter. The book is published by Domestic Engineering Co., Chicago, and sells at $2.50. Copies may be had by addressing the Heating and Ventilating Magazine Co., 1123 Broadway, New York.

Hygienic Value of Gas Lighting, by R. F. Pierce, is a pamphlet containing the article on this subject which was first published in *The Illuminating Engineer,* and which appeared in THE HEATING AND VENTILATING MAGAZINE for November, 1911, almost in its entirety. The article contains the results of recent researches tending to show that gas lights are beneficial in their effects upon the air, that ventilation is increased by gas flames, and that carbonic acid gas from flames is not poisonous. Commenting on what it terms "Some Mistaken Notions in Regard to Light and Ventilation," the writer states: "There is an old notion, still more or less prevalent, that gas light vitiates the air and renders it unfit for breathing. This notion is the result of unsupported theory. It is well known that breathing the air renders it unfit for further use of this kind, and that dioxide is exhaled in the breath; since carbon dioxide is also produced by the burning of gas, it was assumed that gas light must also have a deleterious effect upon the air for breathing purposes. The assumption is the result of a failure to consider all the elements in the problem. When these are all taken carefully into account and subjected to the acid test of scientific experiment, it has been found that, on the whole, gas light distinctly improves the quality of the air of the room in which it is produced."

Humidification from the viewpoint of a practical manufacturer, is a timely and well-written booklet that is being sent out to the trade by the Tillotson Humidifier Co., Providence, R. I. The author discusses the application of humidifying apparatus in connection with such processes as the carding of worsted, worsted combing, worsted drawing and worsted spinning, and then discusses the conditions in the weave room, showing the advantages of proper atmospheric condi-



TILLOTSON HUMIDIFIER IN POSITION, SHOWING TUBULAR HANGER

tions. The application of the Tillotson humidifier to these processes is referred to, emphasis being laid on its simplicity, durability, low cost of maintenance, absence of delicate parts and operation without pumps, steam, air or water pressure. Size 4¼ in. by 6½ in. Pp. 32.

Steam Tables for Condenser Work, recently published by the Wheeler Condenser & Engineering Co., Cartaret, N. J., is a valuable hand book of steam tables with pressures below atmosphere expressed in inches of mercury referred to a 30-inch barometer; also including a discussion of the use of the mercury column, the errors in such measurements and constants for their correction.

In this country, the standard generally accepted for measuring pressure below atmosphere is vacuum in inches of mercury referred to a 30-in. barometer. Ordinary steam tables, however, do not give pressures in vacuums, and there is no generally accepted standard of the properties of steam at say, 28-in. or 28.5-in or 29-in. vacuum, or of just exactly what pressure is represented by any given vacuum referred to a 30-in. barometer. It was with these points in mind that the publication in question has been prepared. The meaning of the term "vacuum referred to a 30-in. mean barometer" is clearly indicated, and it is

then shown that in expressing pressure in these terms, the temperature of the mercury is assumed at 58.4° F., whereas when atmospheric pressure is expressed in terms of a barometer of 29.92-in., the temperature of the mercury is assumed as 32° F.

Following this discussion three steam tables are given. In the first table the independent variable is vacuum, and the properties of saturated steam are given from 29.8-in. vacuum up to atmospheric pressure.

In Table 2 the properties of steam below atmospheric pressure are given from 32° F. to 212° F., the temperature being the independent variable accompanied by the pressure expressed in vacuum in inches of mercury referred to a 30-in. barometer and also expressed in pounds per square inch and inches of mercury absolute pressure, together with other properties of steam.

Table 3 gives the properties of saturated steam from zero to 20 lbs. gauge, the independent variable being gauge pressure, instead of absolute pressure as usually given. The properties of steam may be read off, for instance, at a gauge pressure of 175 lbs. without subtraction of 14.7 lbs. from absolute pressures and without interpolation.

This hand book, which represents a considerable expenditure in time and money, is published primarily for the assistance of engineers using and purchasing condensers and condensing apparatus, to whom it will be sent upon request by the Wheeler Condenser & Engineering Co. Copies are not for sale or general distribution.

Victor Regulators for controlling temperatures and pressures, are discussed in a new catalogue published by the Standard Regulator Co., 90 West street, New York. This type of regulator, which operates through the expansion and contraction of an expanding tube, is shown as properly connected to a hot water tank, to a hot water heater and steam coil, and to a hot water boiler. The catalogue also includes a description of the Victor hydraulic damper regulator, showing its adaptation to a low and high pressure steam boiler. A variation of this device is the Victor compound hydraulic damper and fan engine regulator, which is separately illustrated, besides being shown in a typical installation. Size 6x9 in., pp. 20. Another catalogue illustrates the company's systems of automatic temperature control for all classes of buildings.

Francis Bros. & Jellett, Inc., Dissolving

Announcement is made of the dissolution of the well-known firm of Francis Bros. & Jellett, Inc., of Philadelphia and New York, designing and contracting engineers for steam, plumbing, electrical, mechanical and sprinkler installations. The firm is being succeeded in Philadelphia by Stewart A. Jellett, vice-president and treasurer of the old concern, who has opened an office in the Franklin Bank Building, at Broad and Chestnut streets. In New York the firm's interests have been taken over by W. L. Fleisher & Co., which will continue the business at the same address, 156 Fifth avenue. Mr. W. L. Fleisher, who is the president of the new company, was for many years the New York manager for Francis Bros. & Jellett. The old firm's membership in the Master Steam Fitters' Association and in the Building Trades Employers' Association in New York has also been turned over to W. L. Fleisher & Co.

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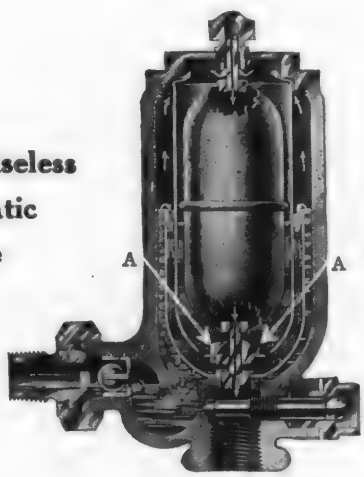

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NOISELESS—Because the **Float** in the valve is incased in a **separate chamber** (A) containing a **still body of water,** thus preventing the chattering of the float by the inrush of steam or water directly onto the float.

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TRADE AND MISCELLANEOUS NOTES

Coming Events

Second Tuesday in Each Month—Meeting of the New York Chapter, American Society of Heating and Ventilating Engineers, Engineering Societies Building, 29 West 39th St., New York.

June 10-13, 1912, inclusive, twenty-fourth annual convention of the National Association of Master Steam and Hot Water Fitters, Atlantic City, N. J. Headquarters at the St. Charles Hotel.

June 25-27, 1912—Fourth annual convention of the National District Heating Association, Detroit, Mich. Headquarters at the Hotel Cadillac.

Deaths

Frank W. Webb, president of the F. W. Webb Mfg. Co., Boston, manufacturers and dealers in heating and plumbing suplies, died at his home in that city, March 4. The F. W. Webb Co., of which Mr. Webb was president and general manager, was organized in 1900, taking over the business of the supply business of the McShane Co. It has grown to be one of the most importatnt concerns of its kind in that section of the country.

Miscellaneous Notes

Illinois Civil Service Commission will hold examinations during April or May of this year to fill present and future vacancies in the Department of Factory Inspection. Among the branches in which special examinations will be held are ventilation, in which the applicants should have both technical training, understand the occupational disease law, and be able to locate and analyze industrial poisons. The position pays $100 per month, with necessary expenses allowed when traveling. Further information may be obtained from W. R. Robinson, secretary of the Illinois Civil Service Commission, Springfield, Ill.

American Institute of Metals is the new name that has been adopted, by constitutional amendment, by the American Brass Founders' Association. The 1912 convention will be held in Buffalo, N. Y., in September, the exact date to be announced later.

Chicago—Six county commissioners recently visited the contagious building of the County Hospital, reported, among other things, the following conditions: The system of heating and ventilating carries disease germs from one floor to another and occasionally causes a patient suffering from one disease to become affected with one or more others. The inspection also disclosed the fact that the system becomes reversed at times so that rooms become too cold for comfort.

Maine Plumbing, Steam, and Metal Salesmen's Association held its annual meeting and dinner March 11th at the Riverton Park Casino, in Portland, Me.

Mattoon, Ill.—The city council has passed an ordinance granting a 32-year extension of the franchise for heating and lighting now held by the Central Illinois Public Service Company.

Kiowa, Kas.—Prominent citizens of Kiowa are talking of installing a municipal heating plant to be operated in connection with the city's lighting system.

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The proposition is to make use of exhaust steam almost exclusively. The Commercial Club is pushing the project.

Berlin, Ont.—Berlin Central Steam Heating Co., has offered to sell its plant to the town of Berlin. Owing to the fact that the company is unable to sell power, the business has not been a profitable one, although the shareholders maintain that the plant would be a money maker if operated under city management. The value of the plant is estimated at $55,000 to $60,000.

Hastings, Neb.—Hastings will shortly vote upon the question of building a municipal heating plant. It is proposed to operate such a plant in connection with the city's other utilities and supply heat both to the business district and to certain portions of the residence district.

Buffalo, N. Y.—Dr. Henry R. Hopkins, former president of the Erie County Medical Society, has served notice on Health Commissioner Fronczak and Comtroller Justice of Buffalo that he will take steps against the retention of the ventilating systems at present in use in the public schools of the city, on the ground that they are inadequate.

Fort Dodge, Ia.—Fort Dodge is to have a central heating plant, according to an announcement made by R. M. Parker, manager for the Fort Dodge Light & Power Co. The plant will be operated in connection with the company's electric station, provided enough subscriptions are secured to warrant the investment and also that a satisfactory franchise is granted. A canvas is now being made of the business district. The company will offer to run, without charge, a service pipe to the inner side of the wall of any building on the line of the proposed mains and the subscriber will be asked to agree to give the proposed heat service a fair trial of three months, as soon as the company is ready to furnish heat. If the consumer is satisfied at the expiration of three months, he agrees to contract for a full year's service. Should he be dissatisfied, he has the right to discontinue the service, but shall refund to the company the actual cost of running the service pipe into his building.

Kansas City, Mo.—Dr. W. S. Wheeler, health commisioner of Kansas City, reports that the street car company is scrubbing its cars with soap and water each day before the cars are sent out on their runs. The nickel theatres are also conforming to the new order, the proprietors whose places are complained of being prompt to ask for instructions as to how the ventilation should be done. The health department's suggestions are promptly carried out.

West Bend, Wis.—The county board has decided to build a $47,000 central heating station and poor house. Work will be started this spring.

Moberly, Mo.—The project of the Moberly Light & Power Co to buid a central heating plant in Moberly is receiving encouragement from the local press. Plans and specifications have been drawn for the proposed plant. It is the intention to supply the business district.

ALL YOU NEED

to transform your present system to an efficient and economical one, are the

SIMONDS VACUUM VALVES

and a small pump. Place the valves on the outlet end of your radiators and coils—start up your pump—your heating wastes are at once Remedied

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Schenectady, N. Y.—In connection with the new county jail, the board of supervisors has decided to have the heating system connected with the heating system in the new county court building, where provisions has been made for the installation of a third boiler to take care of the jail building.

Brazil, Ind.—The Brazil Electric Co. is considering the matter of installing a central station hot water heating system and is being encouraged by many of the city's merchants and property owners. The company is preparing to ask the city council for a franchise for this purpose.

John K. Allen, formerly editor of *Domestic Engineering,* of Chicago, has been appointed advertising manager of the *Christian Science Monitor,* of Boston, a daily published under the auspices of the Christian Science organization.

Cedar Rapids, Ia.—The city council has granted an interurban, electric lighting and steam heating franchise to the Cedar Rapids & Iowa City Light & Power Company.

Chatham, N. Y.—Chatham is considering the proposition of installing a central station heating plant for its business district. The plan is to make use of the exhaust steam from the plant of the local electric light company, also installing additional boiler capacity.

Chicago.—Charge has been made that provision for an adequate heating plant for the proposed $3,000,000 county hospital was not included in the plans for which the architect, Paul Gerhardt, is to be paid $75,000. The matter was brought up by Commissioner George Sultan at a recent meeting of the county board, who declared that the detail had been overlooked and that any attempt to use the old power plant for this purpose would be impractical.

St. Louis, Mo.—Open violation of the engineers' law was brought out in the testimony of the two city department heads who appeared before the legislative committee of the House of Delegates recently when they admitted that they had "followed custom" in ignoring the engineers' license law. The testimony showed that the boiler and elevator inspectors had permitted 53 grammar schools in which engineers are connected with boilers, to be operated without licensed engineers in charge at all times. The affair will probably result in a revision of the engineers' license code.

Kalamazoo, Mich.—The city council has accepted the franchise committee's

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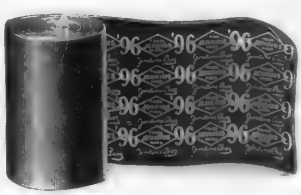

Makes tight and leakless steam joints. And ammonia, oils or acids do not affect it. On permanent work it will last as long as the metals which hold it. For temporary work, when properly applied, it can be used repeatedly. It is strong, tough and flexible.

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draft of a heating franchise asked for by the Central Station Engineering Co., of Chicago. The franchise will now be submitted to the people at a special election. It provides for the completion of the plant by October 1, 1912. The W. H. Schott Co., of Chicago, which had also applied for a franchise, withdrew its application following the action of the city council in ordering a new draft of the proposed franchise in which each company was asked to submit rates for heating. In the final action taken by the city council the proposition as to rates offered by the Central Station Engineering Co. in its original application, was accepted in the report of the ordinance committee.

Birmingham, Ala.—City Attorney Romaine Boyd has rendered an opinion to the city commission to the effect that Section 13 of the ordinance granting a heating franchise to the Birmingham Railway, Light & Power Co. is defective, and that, as a result, the city since 1902 has paid the company $11,850 for which the city is not liable. It appears that there is no record of the proposed substitution for the original section 13 of the ordinance having been adopted, so that all money paid by the city for the heating of the city hall and jail was paid illegally. As a result of the report, a new ordinance will be submitted, setting out a schedule of rates to be charged by the company for heating, it having been established that there is no definite scale at the present time.

Manufacturers' Notes

Simonds Heating & Specialty Co., Grand Rapids, Mich., reports that 147 of its ½-in. and ¾-in vacuum valves have been selected for installation in the 211 coils in the shops of the Chicago & Rock Island Railroad in Chicago. Simonds vacuum valves will also be used for the plant now building of the Continental Motor Works in Detroit, and for the Hoosier Motor Truck Co.'s plant in Grand Rapids.

Indianapolis, Ind. — Indianapolis is competing with Newcastle for the new factory of the Shirley Radiator Co. Its coming to Indianapolis depends upon the people of that city buying 107 building lots which are being sold through the Commercial Club. Newcastle, it is reported, has offered 30 acres of ground for a factory site and $40,000 in cash for the Shirley plant, where the company is now located. In case the company comes to Indianapolis, it will guarantee 12% interest a year to the lot purchasers who will erect homes on such lots and will rent the homes to workers of the factory. If a lot purchaser desires to sell, the radiator company will undertake to find a purchaser among its employees. In discussing the proposal, Nathan T. Washburn, chairman of the Commercial Club's lot selling force, said, "The busines men of Newcastle have a factory-getting method which enables them to swing any desirable proposition that comes along in a few hours. They know by experience that if they buy building lots around a factory, the factory employees will later buy up the property, and a business man can use his

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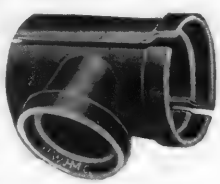

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money again and again for the same purpose. Our effort to bring the Shirley factory to Indianapolis now offers a fine opportunity of trying out the method in Indianapolis."

Later advices state that the new plant will be built in Indianapolis, under the direction of Fred W. Smith.

Buffalo Forge Co., Buffalo, N. Y., announces the removal of its Cincinnati office to 505 Mercantile Library. A. J. Chinn is resident engineer.

Chamberlin Metal Weather Strip Co., Detroit, Mich., has transferred F. K. Davis from the Washington branch, with headquarters in Baltimore, to New York, where he will act as branch engineer. Mr. Davis is a member of the American Society of Heating and Ventilating Engineers and has many friends in the trade in New York who will welcome him to the city.

McCrum-Howell Co., New York, announces the appointment of Edward E. Fox as manager of its New York City branch. Mr. Fox is one of the company's oldest employees.

American Thermostat Co., Elmira, N. Y., has been reorganized with the following officers: President, A. S. Bevens; vice-president, F. F. Aldridge; secretary and treasurer, I. M. Baldwin. The company manufacturers the Marvel thermostat for damper control of furnaces and boilers.

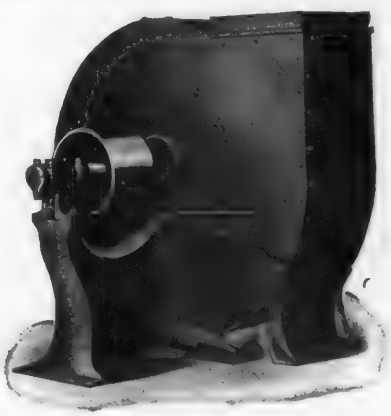
Pittsburg Valve & Fittings Co. is building a new foundry at Barberton, O., of steel construction, 62x650 ft., to be finished April 15. It will be devoted principally to the manufacture of grey iron fittings.

Moline Vacuum Vapor Heating Co., Moline, Ill., announces the appointment of H. G. Thomas as its sales representative in Chicago and vicinity. Headquarters will shortly be established in the Loop district.

Gurney Heater Mfg. Co., has moved into its new plant at South Framingham, Mass.

Canton, O.—The realty, plant and patterns of the Canton Foundry & Heating Co., Canton, O., which were put up at auction sale, were purchased by John V. Brokaw, the purchase price being given as $10,300.

American Radiator Co., Chicago, reports the earnings for the past fiscal year to be the largest in its history. The figures for net profits were $1,312,000, as against $1,197,517 the previous year. The balance of $1,102,000 remaining after the payment of the preferred dividend, is equivalent to 18% on the common stock



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outstanding. In addition to the regular quarterly dividend and the usual extra cash dividend of 2% distributed March 30, the company will pay holders of its common stock a dividend of 10%, amounting to $615,000. This will leave a surplus for the year of $487,052, or a total surplus on hand of $6,007,219.

Billings & Spencer, Hartford, Conn., have secured the manufacturing and selling rights for a new pipe wrench patented by J. F. Wright, Canton, O.

Monash-Younker Co., Chicago, reports a large increase in the demand for its Monash Noiseless Radifier valves as the result of the outcome of the patent suit entered against the company by the Consolidated Engineering Co. and Byron E. Van Auken recently decided in favor of the Monash-Younker Co. by the United States Court of Appeals. The Monash-Younker Company is building a new plant at Chicago for the manufacture of the Radifier valves on a large scale. This company states that it is one of the first to sell a float valve for vacuum heating, doing away with the extra charge for royalty or engineering services.

Atlantic Radiator Co., Philadelphia, Pa., announces that it is engaged in making repairs and extensive improvements to its plant at Huntington, Pa., including the enlargement of its buildings and equipment and, as a result, has temporarily closed its foundry. The company has an ample stock of radiation on hand, however, and states that there will be no delay in filling orders. Bids are being taken for a new core room, 60 ft. x 80 ft., with necessary equipment, an electric elevator for the cupola, and a new testing plant. New patterns are being prepared to enable the foundry to be run at its maximum capacity. Judson A. Goodrich as announced in this column, recently been appointed manager of this company.

Tyler Underground Heating Systems, Pittsburg, Pa., announce that their materials have been installed at the Nordyke Marmon Comany's new plant at Indianapolis, Ind., including casings, anchors and exoansion joints.

Pullman Automatic Ventilator Mfg. Co., York, Pa., reports a large demand for its new type of swinging top chimney cap, the invention of its engineer, John M. Cromley. The cap is made in 6 in., 7 in. and 8 in. sizes and is put up in crates of not less than ½-doz., either in one size or assorted sizes. This ventilator is made of galvanized iron and has a brass ball bearing which does not corrode, giving positive action at all times. This company, which is a pioneer in the

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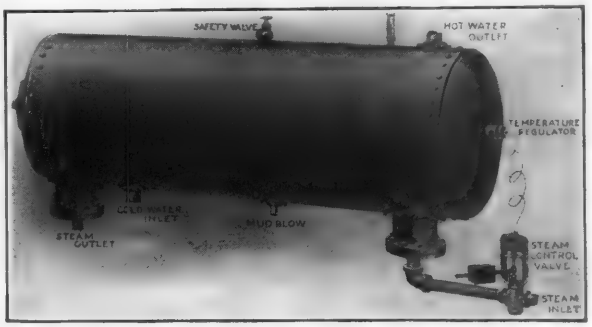

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open-type roof ventilators, has preserved the open type in the new design, the cap closing against the wind.

New Corporations

Warden Heating & Supply Co., Wellsburg, W. Va., capital $50,000, to manufacture and install heating and ventilating systems. Incorporators: W. J. Warden, S. M. Warden, L. M. Reffner, C. D. Posey, and Henry Poset, all of Wellsburg.

Van Auken-Rice Corporation, Adams, N. Y., capital $25,000, general manufacturing, construction and engineering, heating and ventilating apparatus and supplies. Incorporators: B. H. Van Auken, Syracuse, N. Y.; W. S. Rise and A. P. Andrews, Adams.

Central Heating Co., Anderson, Ind., capital $130,000, to operate a public service heating plant under a franchise granted to Otis P. Crim. Directors: O. P. Crim, J. L. Vermilion, J. W. Lovett, M. G. Reynolds and Allen Richwine.

Ehrlich & Co., Chicago, Ill., capital $10,000, to design and install heating and ventilating plants. Incorporators: Charles H. Ehrlich, Morris A. Weinberg and Louis Grollman.

Barrett Plumbing & Heating Co., Jersey City, N. J., capital $10,000, to conduct general heating and plumbing business. Incorporators: Johanna G. Barrett, Leonia, N. J.; John F. Barrett, New York and Ralph G. Barrett, Leonia, N. J.

Porcupine Water Heater Co., Cleveland, O., capital $10,000, to manufacture a new water heater for domestic service, also small heating boilers. J. F. Jones, 11,109 Superior Ave., who is the designer of the apparatus, is secretary and general manager.

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Gould Co., Southington, Conn., capital $50,000, to take over heating and plumbing business conducted by W. S. Gould and his son, W. S. Gould, at that place.

McGuire Bros. & Co., Rockford, Ill., capital $60,000, to take over the steam fitting and plumbing business of McGuire Bros., of that city. Incorporators: William F. McGuire, Charles E. McGuire, Bert A. McGuire and A. D. Early.

South Orange Plumbing Co., South Orange, N. J., capital $10,000, to conduct heating and plumbing contracting business. Incorporators: George L. Smith, Cornelius F. Smith, and James P. Smith, all of South Orange.

Shorthill Plumbing Co., Canton, O., capital $15,000, to conduct a general heating, plumbing and lighting business. Incorporators: James H Shorthill, William Schweig, George Edel, Albert Kauffman and Joseph Kauffman.

Adams Plumbing Co., Wilmington, Del., capital $100,000, to conduct a general heating and plumbing business. Incorporators: H. S. Adams, C. R. Mudge and W. E. Stover.

Jennings-Gresham Co., Atlanta, Ga., capital $25,000, to conduct a heating and plumbing business. Incorporators: J. H. Jennings, V. R. Gresham and J. S. Warmack.

American Packless Valve & Mfg. Co., Chicago, capital $100,000, to manufacture and deal in steam specialties, brass goods, etc. Incorporators: L. J. Kadeski, Michael F. Girth and Joseph J. Thompson.

Whittaker & Schabel Co., Memphis, Tenn., capital $10,000, to conduct a heating, plumbing and electrical business. Incorporators: J. F. Whittaker, T. B. Schabel, C. A. Gerber, etc.

New Firms and Business Changes

Ashley & Kaufman, 417 Fifth Ave., New York, is a new firm of consulting engineers for heating, lighting, ventilating, refrigerating and sanitary installations, composed of Edward E. Ashley, Jr., and Alfonse Kaufman. Some of the work which the company now has on hand includes the engineering on the Albany High School, one of the largest buildings of its kind in the country; a 12-story hotel in Jacksonville, Fla., a 20-story building for the Hess Building Co., at 26th St. and Fourth Ave., New York, and a $2,000,000 hotel in Pittsburgh.

Osborn Engineering Co., Cleveland, O., announces that it has moved its main offices to 740 Engineers' Building, in that city.

Patent Heating Co., Toledo, O., has reduced its capital stock from $300,000 to $10,000.

Premier Vacuum Cleaning Co., Cleveland, O., has increased its capital stock from $10,000 to $50,000. The company manufactures the Premier electric and Ezee hand vacuum cleaners.

Hanratty Co., Springfield, Ill., has been organized to take over the heating and plumbing business conducted for many years by the late O. Hanratty at 406 South Sixth St., Springfield. The new company will be conducted under the management of John H. Hanratty, assisted by his brother, Thomas J. Hanratty.

Contracts Awarded

St. John Plumbing Co., Colorado Springs, Colo., lighting, heating, ventilating and vacuum cleaning plant for Centennial high school at Pueblo, for $17,000. Two high-pressure horizontal tubular boilers will be used. The Connersville system of vacuum cleaning will be installed.

Kohlert & Harter, St. Charles, Ill., steam heating for new Fred Pearson block in that place.

Memphis Southern Heating & Electrical Co., Memphis, Tenn., heating Western Hospital for the Insane at Bolivar.

Love, Roth & Nelson Co., Cincinnati, O., heating county infirmary building at Hamilton, O., for $9,500. The next lowest bidder was the Walker Co., Hamilton, $9,530.

E. R. Brown, Duluth, Minn., heating court house building at Grand Rapids, Mich.

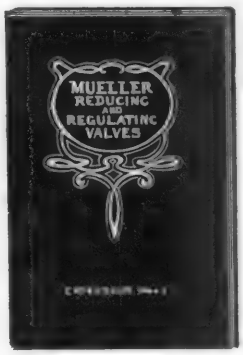
Cambria Plumbing & Heating Co., Cambria, Pa., hot water heating system for the new freight station for the B. & O. Railroad at Johnstown. The contract also calls for complete toilet facilities in the basement and a 4-in. line, with 2-in. connections and five sets of hose racks for fire protection in the office and freight shed.

F. A. Clegg & Co., Louisville, Ky., heating Ideal Theatre in that city. A Milone vapor-vacuum heating system will be installed.

Thos. Haverty Co., Los Angeles, Cal., heating and ventilating system for Title Insurance & Trust Co., in that city.

Blumve & Jay, Los Angeles, Cal., heating, ventilating and plumbing new 11-story office and theatre building on Broadway, for William Garland. Contract price, $21,330.

Machinery & Electrical Co., Los Angeles, Cal., heating Euclid Avenue Grammar chool at Ontario, Cal., for $3,271. The plumbing contract went to the Dederichs Hardware Co., of Ontario, at its bid of $4,287.



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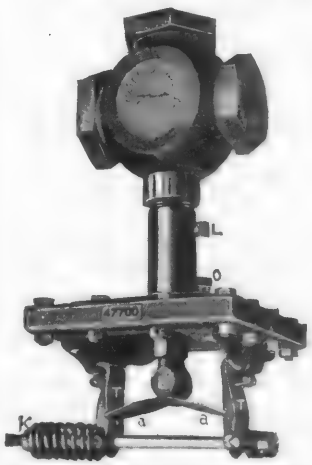

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Washington, D. C.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, for the following-named work:

Until April 26, 1912, for the construction complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring and interior lighting fixtures of the United States Post Office at Johnstown, Pa.

Until May 1, 1912, for the installation of a vacuum cleaning system in the United States Post Office at Oklahoma City, Okla.

Until May 7, 1912, for the construction, including plumbing, gas piping, heating apparatus, electric conduits, wiring and interior lighting fixtures of the United States Post Office at Olympia, Wash.

London, O.—Bonds to the amount of $20,000 have been sold to erect a new heating plant for the public school buildings of that place.

Trade Literature

Vacuum and Vapor Heating Specialties—Armak Systems, is the title of a new general catalogue just published by the Armak Company, Marbridge building, New York. The Armak system was designed by Arthur McGonagle, of New York, and has long been in successful use. In the catalogue the various devices used in this system are illustrated and described, including the vacuum pump, the automatic relief valve, which is of the float type, and the Armak thermostatic valve, Armak radiator check and check valves, two types of the Armak vacuum controller, and the Armak vacuum trap, vent valve, vacuum pump regulator, suction strainer and separating tank. The company also sells the Armak graduated inlet valve. The line, in short, is complete for such specialties as are necessary to the proper installation of vacuum and vapor systems of heating. A special circular issued by the company shows the application of the Armak system to hot blast heaters. Size, 3½ x 6 in. (standard). Pp. 24.

Eclipse Pipe Hangers for pipes and for indirect radiators, also beam clamps and hanger couplings, are shown in new circular matter issued by the Morgan Spring Co., Worcester, Mass. The Eclipse pipe hangers consist of two parts—the ring, which is a formed steel wire; and the yoke, which is a steel stamping. The ring may be snapped into and removed from the yoke. The ring fits behind the shoulder in the yoke, and the two parts cannot be separated without deliberately compressing the neck of the ring. The circular gives further details, with various views, of these interesting devices. Size, 3½ x 6 in. (standard). Pp. 12.

Komo Steam Traps, for the separation of the water of condensation from steam from any source where economy is desired, manufactured by the Linton Machine Co., 26 Cortlandt street, New York, are presented in a new catalogue issued by this firm. The Komo trap is constructed on the thermostatic principle, although the manufacturers state that it should not be confused with the ordinary "expansion" trap, as its construction is entirely different. The receiver tubes are made of a special composition metal very sensitive to changes of temperature, and their movement due to expansion and contraction is communicated to the discharge valve by bowed side rods. Additional details of the operation of the valve are contained in the catalogue, as well as data concerning the Linton exhaust head, Linton steam separator and Linton muffler and oil extractor. Size, 6 x 9 in. (standard). Pp. 16.

Sprague Electric Fans, including desk and bracket fans, telephone booth fans, ceiling fans, etc., operating on direct and alternating current, are the subject of an elaborate and unusually complete catalogue issued by the Sprague Electric Works of the General Electric Co., New York. The catalogue is handsomely gotten up, with decorations in color, and is complete both as to data and price lists. Size, 8 x 10½ in. Pp. 40.

Insulation, a new catalogue featuring the Ric-Wil pipe covering products, made by the Richards-Wilson Pipe Covering Co., Grand Rapids, Mich., describes in detail the company's line of pipe insulation for high and low pressures, frost-proof coverings, cork insulation and underground pipe coverings. Special attention is directed to the Ric-Wil underground pipe covering, consisting of vitrified tile lined with a mineral insulation which is described as the only material in which both casing and insulation are integral. It is furnished in both plain and channel type. Price lists are included as well as specifications of dimensions, weights, etc., of Ric-Wil underground pipe coverings. Size 5½ in. x 7¾ in. Pp. 20.

Ferro Engines, is a new catalogue of remarkable elegance, described as a practical treatise on correct design and construction for layman, experienced boatman and boat builder. It is published by the Ferro Machine & Foundry Co., marine engine builders, Cleveland, O. size 9 in. x 12 in. (standard). Pp. 48.

Thermometers and Thermographs for indicating and recording temperature are the subject of a new bulletin (Bulletin No. 58) published by the Industrial Instrument Co., Foxboro, Mass. All of the instruments shown were designed by Edgar H. Bristol and Bennett B. Bristol. The company's line of instruments of this type is comprehensively covered in this

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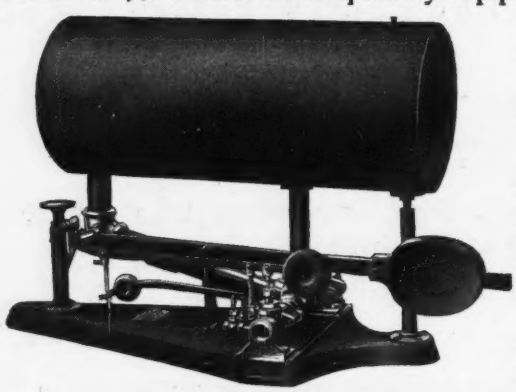

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